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ABSTRACT

This curriculum guide for a 1-semester or 1-year course on construction systems is designed to acquaint students with the nature of the construction industry and its technology--tools, materials, and methods of construction--as well as the systems for planning and managing construction projects. The guide contains a course outline, competencies (task lists), student competency records, and management sheets. Management sheets, which serve as lesson outlines used for 1 or more days, include the following: an introduction, an enabling objective, a performance objective, an equipment and supplies list, a performance standard, suggested references for teachers and students, activities, and evaluation criteria. Some of the topics covered by the activities are as follows: introduction to construction, construction planning and management, earthwork and foundations, superstructures, exterior finishing and roofing, mechanical and electrical systems, insulation and interior finish, and special projects. The guide contains six appendixes: (1) a tool and equipment list; (2) a supply list; (3) a resource list of 18 books, 53 films, slide sets or videotapes, 4 software programs, and 5 kits for models; (4) a suggested facility layout; (5) a corner section drawing; and (6) definitions. (KC)

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Curriculum Guide
for
Technology Education
CONSTRUCTION SYSTEMS

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TABLE OF CONTENTS

	page
ACKNOWLEDGMENTS	v
INTRODUCTION	vii
A. Goals and General Objectives	viii
B. Course Time Frame	ix
COURSE OUTLINE	xi
COMPETENCY LIST	xv
STUDENT COMPETENCY RECORD	xvii
MANAGEMENT SHEETS	1
APPENDICES	153
A. Tool and Equipment List	155
B. Supply List	157
C. Resources and References	159
D. Suggested Facility Layout	169
E. Corner Section Drawing	171
F. Definition of Terms	173

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INTRODUCTION

If a single goal of technology education could be stated, it would include, if not consist of, developing technological literacy. In a world where technology is overwhelmingly prevalent, it is imperative that people have some knowledge of that technology in order to make use of it to enrich, rather than detract from, their quality of life. Four of the most important systems which create and utilize technology are Manufacturing, Construction, Communication, and Transportation.

The major industrial activity of this country is production of goods and services. The production of goods falls into two categories--manufacturing and construction. Manufacturing normally refers to items produced in a factory, whereas construction results in structures built on site. Because the products, or outputs of construction are roads, bridges, dams, factories, buildings, and other structures, everyone is in constant contact with, and their lives are affected by these outputs. It follows, then, that anyone could benefit from a study of the technology of construction, because it should make them more able, efficient, and intelligent users of structures.

In addition to the general applicability of construction technology, it is also true that since the construction industry employs over 3 1/2 million workers and generates a significant portion of the U.S. Gross National Product, a

number of students from any given school will eventually work in that industry. Many others will work in fields related to construction, such as engineering, architecture, interior design, landscaping, maintenance, and inspection. For these students, a study of construction technology is a valuable opportunity to explore their future vocation.

Goals and General Objectives of the Course

The main goal of a course in Construction Systems at the high school level is to acquaint students with the nature of the construction industry and its technology, namely the tools, materials, and methods of construction, as well as the systems for planning and managing construction enterprises. The general objectives of the course are:

1. To introduce students to the nature, size, and scope of the construction industry.
2. To help students gain an understanding of the importance and function of construction technology in their lives.
3. To provide opportunities for students to engage in construction-related, hands-on activities.
4. To help students gain an understanding of structures and structural systems.

A course in construction systems is only part of a comprehensive technology education program. Together with a course in construction design and planning, it should comprise a significant part of the program. The other areas of technology education are designed to illuminate separate and distinct technological systems, so there is little overlap in content. In another sense, however, the concepts

and outcomes of manufacturing, communication, and transportation are all involved in construction.

Also, there should be many opportunities for mathematical, scientific, and social concepts and principles to be used in a construction course. While the application of such principles is not always stated as a goal, it is certainly one of the distinct benefits of construction technology, and technology education in general.

It should be noted that most of the activities for the course involve the use of tools and/or power equipment, for which safety instruction must be given. The course materials are written under the assumption that the instructor provide safety instruction whenever it is needed.

Course Time Frame

Construction systems may be taught as either a one- or two-semester course. In the following list of competencies, the time suggested for each duty area for a two-semester format appears opposite the name of the duty area. In addition to the days shown, at least seven days should be allocated for tests, and three days for make-up or contingency time.

For a one-semester format, the following changes are suggested:

Omit competencies COS-007 to COS-016	23 days
Omit competencies COS-022, 039, 040, 043, 044, 046, 047, 049,050	23 days
Omit competencies COS-051 to COS-059	29 days
Omit special project COS-060	29 days
	89 days

Another means of achieving a 90-day format would be to retain the special project and omit competencies COS-028 to COS-032, on superstructures. Since this would eliminate the building of a storage building or similar structure, any other units which utilized the structure may need to be modified.

The competencies which are to be retained for a 90-day format are marked with an asterisk on the Competency List.

CONSTRUCTION SYSTEMS
Course Outline

I. Introduction to Construction

- A. Construction meets human needs
- B. The importance of construction
- C. The nature of construction
  - 1. General characteristics
  - 2. Construction is big business
  - 3. Types of construction
- C. Construction occupations
- D. Construction-related occupations

II. Construction Planning and Management

- A. Community planning
- B. Selecting a site
- C. Surveying and mapping
- D. Designing structures
- E. The systems model
- F. Contracting
- G. Estimating and bidding
- H. Scheduling

III. Earthwork and Foundations

- A. Building codes and regulations
- B. Preparing the site
- C. Site utilities
- D. Purpose and function of foundations
- E. Materials for foundations
- F. Building foundations

IV. Superstructures

- A. Components of superstructures
- B. Function of superstructures
- C. Materials for superstructures
- D. Floor systems
- E. Wall systems
- F. Roof systems

V. Exterior Finishing and Roofing

- A. Purpose and function of roofing
- B. Types of roofing materials
- C. Applying roofing
- D. Exterior trim
- E. Exterior wall coverings
- F. Applying siding
- G. Paint and caulk

H. Applying caulk and painting

VI. Mechanical and Electrical Systems

A. Types of systems
B. Purpose and function of systems
C. Electrical components and materials
D. Installing electrical systems
E. Plumbing components and materials
F. Installing plumbing systems
G. HVAC systems
H. Communication systems

VII. Insulation and Interior Finish

A. Insulation materials, forms, and uses
B. Placing insulation
C. Types of wall and ceiling materials
D. Installing drywall
E. Millwork and molding
F. Installing molding
G. Cabinets

VIII. Special Projects

Construction Systems
COMPETENCIES

DUTY: Introduction to Construction 9 days

*COS-001. List five human needs met by construction and identify structures in the community which meet each need.

*COS-002. Match six examples of structures and approximate price ranges.

*COS-003. List five ways in which construction may be of help in your life.

*COS-004. Identify and list the duties and qualifications for some common construction or construction-related occupations.

*COS-005. Compare and contrast construction and manufacturing, and classify construction according to the characteristics and uses of structures.

*COS-006. Identify and classify structures according to the structural system used.

DUTY: Construction Planning and Management 23 days

COS-007. List the main purposes of community planning.

COS-008. List the factors to consider in the selection of a construction site.

COS-009. Explain the purpose and general concepts of surveying and mapping.

COS-010. Identify the tools and instruments used by surveyors.

COS-011. Explain the process of locating boundary lines for a building lot.

COS-012. Carry out the various steps in the design process for structures, including making a sketch of a structure.

COS-013. Apply the general systems model to construction.

COS-014. Describe some common types of contracts used in construction.

COS-015. Estimate the cost of materials for a small structure.

COS-016. Prepare a schedule for the construction of a small structure.

DUTY: Earthwork and Foundations 18 days

---

*COS-017. Apply for a building permit.

*COS-018. List some of the factors to be taken into account when clearing a construction site.

*COS-019. Describe the process for locating a structure on a site.

*COS-020. List the factors to consider in preparing a construction site.

*COS-021. Describe a method of doing earthwork to prepare a site for building.

COS-022. Name the utilities needed for construction work and for structures.

*COS-023. Explain the purpose and function of foundations.

*COS-024. Identify the materials and components used in foundations.

*COS-025. Build a simple form for a footing section.

*COS-026. Mix and place concrete.

*COS-027. Build a concrete block or brick wall section.

DUTY: Superstructures 27 days

---

*COS-028. Define, identify types, and list the components of superstructures.

*COS-029. Describe the function and list the components and materials used in floor, wall, and roof systems.

*COS-030. Build a wood-frame floor system.

*COS-031. Build a wood-frame wall system.

*COS-032. Build a wood-frame roof system.

DUTY: Exterior Finishing and Roofing 28 days

*COS-033. State the purpose and function of roofing and name some common roofing materials.

*COS-034. Apply shingles on a wood-frame roof.

*COS-035. Install a plywood soffit and cornice return.

*COS-036. Install a pre-hung door and a window in a wood-frame wall.

*COS-037. State the purpose and function of exterior wall coverings, and name some of the materials commonly used.

*COS-038. Apply siding on a wood-frame wall.

COS-039 Describe the purpose and function of paint and caulk, and name some common types of each.

COS-040 Apply caulk around a door or window and paint a building exterior.

DUTY: Mechanical and Electrical Systems 22 days

*COS-041. Name the common mechanical and electrical systems in a building, and describe their purpose and function.

*COS-042. Name the principal components of electrical systems and their function, and plan the circuits for a small residence.

COS-043 Install electrical wiring in walls and ceilings.

COS-044 Install and connect switches and duplex receptacles.

*COS-045. Name the principal components of plumbing systems and identify the common pipe fittings.

COS-046 Install plastic pipe in a wall section.

COS-047 Install copper pipe in a wall section.

*COS-048. Name some common methods of connecting copper and plastic pipe and fittings.

COS-049 State the general principles and name some of the main types of HVAC systems.

COS-050 Name some common types of communications systems used in buildings and identify the major components of each.

DUTY: Insulation and Interior Finish 14 days

COS-051 State the reasons for insulating, name the materials from which insulation is made, and the forms in which it is available.

COS-052 Place insulation and vapor barrier in a wall or ceiling.

COS-053 List the most common types of wall and ceiling finishing materials.

COS-054 Apply gypsum board to walls and ceilings.

COS-055 Tape and finish a drywall joint.

COS-056 Describe some common types of kitchen and bath cabinets, and the associated attachments.

COS-057 Define millwork and molding and cite examples of each.

COS-058 Install one type of molding in a building.

COS-059 Name several types of finish flooring and the general characteristics of each.

DUTY: Special Projects 29 days

COS-060 Design and build a project related to construction.

170 days

Tests and make-up 10 days

180 days

*Competencies required for 90-day course in Construction Systems.

STUDENT COMPETENCY RECORD

School_____
Student_____

School Year_____
Instructor's Name_____
Course Title_____
Classification_____

Student Address_____
_____ _____
Zip

Comments_____
_____
_____
_____
_____

The student should be evaluated according to the performance ratings listed. Indicate on this form the numeric rating of the student's performance for each item.
(1) Competency in Process
(2) Competency Performed with Close Supervision
(3) Competency Performed with Limited Supervision
(4) Competency Performed without Supervision

COMPETENCIES

	*COS-001. List five human needs met by construction and identify structures in the community which meet each need.
	*COS-002. Match six examples of structures and approximate price ranges.
	*COS-003. List five ways in which construction may be of help in your life.
	*COS-004. Identify and list the duties and qualifications for some common construction or construction-related occupations.
	*COS-005. Compare and contrast construction and manufacturing, and classify construction according to the characteristics and uses of structures.
	*COS-006. Identify and classify structures according to the structural system used.
	COS-007. List the main purposes of community planning.
	COS-008. List the factors to consider in the selection of a construction site.
	COS-009. Explain the purpose and general concepts of surveying mapping.
	COS-010. Identify the tools and instruments used by surveyors.
	COS-011. Explain the process of locating boundary lines for a building lot.

*Competencies necessary for 1/2 year course.

	COS-012. Carry out the various steps in the design process for structures.
	COS-013. Apply the general systems model to construction.
	COS-014. Describe some common types of contracts used in construction.
	COS-015. Estimate the cost of materials for a small structure.
	COS-016. Prepare a schedule for the construction of a small structure.
	*COS-017. Apply for a building permit.
	*COS-018. List some of the factors to be taken into account when clearing a construction site.
	*COS-019. Describe the process for locating a structure on a site.
	*COS-020. List the factors to consider in preparing a construction site.
	*COS-021. Describe a method of doing earthwork to prepare a site for building.
	COS-022. Name the utilities needed for construction work and for structures.
	*COS-023. Explain the purpose and function of foundations.
	*COS-024. Identify the materials and components used in foundations.
	*COS-025. Build a simple form for a footing section.

	*COS-026	Mix and place concrete.
	*COS-027	Build a concrete block or brick wall section.
	*COS-028	Define, identify types, and list the components of superstructures.
	*COS-029	Describe the function and list the components and materials used in floor, wall, and roof systems.
	*COS-030	Build a wood-frame floor system.
	*COS-031	Build a wood-frame wall system.
	*COS-032	Build a wood-frame roof system.
	*COS-033	State the purpose and function of roofing and name some common roofing materials.
	*COS-034	Apply shingles on a wood-frame roof.
	*COS-035	Install a plywood soffit and cornice return.
	*COS-036	Install a pre-hung door and a window in a wood-frame wall.
	*COS-037	State the purpose and function of exterior wall coverings, and name some of the materials commonly used.
	*COS-038	Apply siding on a wood-frame wall.
	COS-039	Describe the purpose and function of paint and caulk, and name some common types of each.
	COS-040	Apply caulk around a door or window and paint a building exterior.
	COS-041	Name the common mechanical and electrical systems in a building, and describe their purpose and function.
	*COS-042	Name the principal components of electrical systems and their function, and plan the circuits for a small residence.
	COS-043	Install electrical wiring in walls and ceiling.
	COS-044	Install and connect switches and duplex receptacles.
	*COS-045	Name the principal components of plumbing systems and identify the common pipe fittings.
	COS-046	Install plastic pipe in a wall section.
	COS-047	Install copper pipe in a wall section.
	*COS-048	Name some common methods of connecting copper and plastic pipe fittings.
	COS-049	State the general principles and name some of the main types of HVAC systems.
	COS-050	Name some common types of communications systems used in buildings and identify the major components of each.
	COS-051	State the reasons for insulating, name the materials from which insulation is made, and the forms in which it is available.
	COS-052	Place insulation and vapor barrier in a wall or ceiling.
	COS-053	List the most common types of wall and ceiling finishing materials.
	COS-054	Apply gypsum board to walls and ceilings.
	COS-055	Tape and finish a drywall joint.
	COS-056	Describe some common types of kitchen and bath cabinets, and the associated attachments.
	COS-057	Define millwork and molding and cite examples of each.

	COS-058 Install one type of molding in a building.
	COS-059 Name several types of finish flooring and the general characteristics of each.
	COS-060 Design and build a project related to construction.

MANAGEMENT SHEETS

INTRODUCTION TO CONSTRUCTION

PERFORMANCE OBJECTIVE (1 day)

TASK/COMPETENCY: (COS-001) List five human needs met by construction and identify structures in the community which meet each need.

EQUIPMENT/SUPPLIES: Worksheet

STANDARD OF PERFORMANCE: Worksheet will be completed with at least 75% accuracy, based on the information presented in the filmstrip.

REFERENCES

TEACHER	STUDENT
1. Recommended Exploring Construction, Chapter 1, "Introduction to Construction Technology." 2. Suggested Exploring the Construction Industry, Concept 1, Bennett & McKnight Publishers.	1. Recommended Exploring construction, Chapter 1, "Introduction to Construction Technology

SELECTED AUDIOVISUAL MATERIALS: Filmstrip/cassette, "How Construction Meets Your Needs," Introduction to Construction series, Bennett & McKnight Publishers.

ACTIVITIES

TEACHER	STUDENT
1. Introduce topic by discussing the importance of the construction industry, emphasizing its size in terms of numbers of employees as well as the value of its products. Also note the relationship of structures to society--the subject of the filmstrip.	1. Listen, discuss, take notes.

TEACHER	STUDENT
2. Show filmstrip.	2. View filmstrip.
3. Hand out worksheet and have students complete it in time remaining, along with the Exploring Construction Student Manual, pp. 5-6.	3. Complete worksheet and Student Manual.

Worksheet

HOW CONSTRUCTION MEETS YOUR NEEDS

Human Need	Structure	Example in Community
1.		
2.		
3.		
4.		
5.		

INTRODUCTION TO CONSTRUCTION

PERFORMANCE OBJECTIVE (2 days)

TASK/COMPETENCY: (COS-002) Match six examples of structures and approximate price ranges.

EQUIPMENT/SUPPLIES: Measuring tape, real estate advertisements, assignment sheet.

STANDARD OF PERFORMANCE: The student will be able to match five of the six examples correctly.

REFERENCES

TEACHER	STUDENT
2. Suggested Handbook of Labor Statistics, Latest Edition, National Bureau of Labor.	1. Recommended Handout (Assignment sheet)

ACTIVITIES

TEACHER	STUDENT
1. At the class meeting prior to this one, the students should be directed to measure their house and bring the dimensions to class. 2. Discuss the importance of construction, both in terms of the number of people employed and the value of the products of construction.	1. Measure the house you live in, omitting porches, garage, and unfinished basement.

TEACHER	STUDENT
3. Hand out the assignment sheet. Lead students through one example of figuring cost per square foot.	3. Listen, take notes, ask questions.
4. Have students complete assignment sheet. It would be helpful if several pages of real estate advertisements from local or regional newspapers were provided.	4. Complete assignment sheet according to instructions.

Assignment Sheet

THE IMPORTANCE OF CONSTRUCTION

Introduction

The construction industry is very large, employing almost 4 million workers. To get an idea of what that means, compare it to the largest manufacturing industry (machinery manufacturing) which employs about 2 million workers. Automobile manufacturing is often regarded as a large industry, but its work force is well under a million. One out of every 22 workers in this country work in the construction industry.

Another way of looking at the importance of the construction industry is to look at the value of its products. The average family spends more on housing than any other item except food. This is understandable when you consider that over $350 billion dollars worth of construction is completed every year in the U.S.

The cost of a building or its value when sold is often expressed in cost per square foot of floor space. In 1987, the cost of building a single-family dwelling ranged from a low of about $40 per square foot up to more than $60 per square foot, depending on location and type of structure. If you know the approximate building cost per square foot, it is easy to figure how much a house of a certain size will cost. For instance, a 1200 square foot house at $50 per square foot would be 50 x 1200 or $60,000. In reverse, if you know the price of an existing house and its square footage, it is easy to figure the cost per square foot. A house with 1400 square feet of floor space, selling for $80,000 would be figured: 80,000/1400 = $57.00 per square foot.

The cost of commercial and engineered construction varies greatly, but will generally be more than for residential structures.

Assignment

1. A builder estimates that the building cost for your area is about $45 per square foot for a single-family dwelling. How much would it cost for you to build a 1500 square foot house? _____

2. A house is for sale for $60,000 near where you want to build, but it has only 1400 square feet. What is its cost per square foot?_____

3. Which of the two houses would you rather have, and why? _____

_____

_____

4. Find out from your instructor the approximate building costs for your area, then measure the house you live in and find out how much floor space it has (porches, garages, and unfinished basements are not normally counted). Figure the replacement cost of your home by multiplying the total square footage by the cost per square foot.

   Square footage _____
   Cost per sq. ft. _____
   Replacement cost _____

5. From real estate advertisements in the newspaper, figure the cost per square foot of at least one home.

   Type of house(brick, frame, etc.) _____

   Location _____

   Price _____

   Square footage _____

   Cost per square foot _____

6. If commercial construction costs were $100 per square foot in your city, how much would it cost to build an office building 90 feet by 90 feet, 30 stories high?

   Sq. ft. one floor _____

   Total sq. ft. _____

   Total cost _____

7. In the following list, match structures and the price ranges. One price range may be used for more than one structure.

___	Nuclear power plant	a.	$50,000--$100,000
___	High school for 1,000 students	b.	$100,000--$500,000
___	Single-family house, 2,000 sq. ft.	c.	$1,000,000-$10,000,000
___	20-story office bldg.	d.	$10,000,000-$25,000,000

___ Metropolitan airport

___ McDonald's restaurant

e. $50,000,000 or more

INTRODUCTION TO CONSTRUCTION

PERFORMANCE OBJECTIVE (1 day)

TASK/COMPETENCY: (COS-003) List five ways in which construction may be of help in your life.

EQUIPMENT/SUPPLIES: WIT and WOT cards.

STANDARD OF PERFORMANCE: 75% correct, according to the information in the textbook, and Activity 2B.

REFERENCES

TEACHER	STUDENT
1. Recommended Exploring Construction Chapter 2, "What is Construction Technology?", and Activity 2B, "Roleplay: A situation with WITs and WOTs," Instructor's Guide.	1. Recommended Exploring Construction Chapter 2, "What is Construction Technology?"

SELECTED AUDIOVISUAL MATERIALS: WIT and WOT cards from Exploring Construction Instructor's Manual.

ACTIVITIES

TEACHER	STUDENT
1. Start the Activity by distributing the WIT and WOT cards. Make duplicates if more are needed. Each student must have a card. 2. Do not tell students what WIT and WOT means. 3. Ask them NOT to let others see their cards. 4. Introduce the activity by telling them that you have SITUATION they need	

TEACHER	STUDENT
to consider. The category (classifies type of response expected) of the situation is in capital letters across the top of the card.	
5. Only the students with the situation stated by the teacher can respond. The rule is that students cannot go beyond the information on the card unless it says they can.	
6. The teacher reads the SITUATION card.	
7. Give the students with the category a minute or two to devise their answers.	
8. Ask the other students to write their responses on their Activity Sheets.	
9. Ask the WOTs to respond first.	9. Give answers as directed.
10. Then ask WITs to respond. DO NOT DISCUSS THE RESPONSES.	10. Give answers as directed.
11. Repeat steps 6-10 until all seven situations have been covered or until there are 5-10 minutes of the class period left.	
12. Summarize by stating that the WIT and WOT refers to knowledge about construction technology. The WITs are With IT and the WOTs are WithOut iT.	
13. Lead a discussion on why we need to study Exploring Construction Technology.	13. Participate in discussion.

INTRODUCTION TO CONSTRUCTION

PERFORMANCE OBJECTIVE (1 day)

TASK/COMPETENCY: (COS-004) Identify and list the duties and qualifications for some common construction or construction-related occupations.

EQUIPMENT/SUPPLIES: Assignment sheets.

STANDARD OF PERFORMANCE: The worksheet will include at least three duties and two qualifications for one occupation.

REFERENCES

TEACHER	STUDENT
1. Recommended Exploring Construction, Chapter 11, "Getting Workers/ Career Choices." 2. Suggested Introduction to Construction. Chapter 1, "The Construction Industry."	1. Recommended Exploring Construction, Chapter 11, "Getting Workers/Career Choices."

SELECTED INSTRUCTIONAL MATERIALS: Filmstrip/cassette, "Contractors at Work", World of Construction series.

ACTIVITIES

TEACHER	STUDENT
1. At a previous class meeting give each student an assignment sheet and instruct them to complete it as a homework assignment. Give some examples of construction and construction-related jobs.	1. Make sure the instructions are clear.
2. Show filmstrip.	2. View filmstrip

TEACHER	STUDENT
3. Have each student report his or her results on the assignment sheet to the class.	3. Identify the occupation, and describe the duties and qualifications for the job.

Assignment Sheet

CONSTRUCTION AND CONSTRUCTION-RELATED OCCUPATIONS

Because of the size of the construction industry, almost everyone has some contact with someone who works in construction directly or in an occupation closely related to construction. Your assignment is to find such a person and interview him or her to find out the duties and qualifications for the job.

Interview Questions and Notes

What is your job title? _____

How long have you worked at this job? _____

What are three things you do regularly as part of your job (duties)? _____

_____

_____

_____

Did you have any training or education for this job? _____

What kind? _____

How are most people who work in this occupation trained at the present time? _____

What do you like most about your work? _____

What do you like least about your work? _____

PERFORMANCE OBJECTIVE (1 day)

TASK/COMPETENCY: (COS-005) Compare and contrast construction and manufacturing and classify construction according to the characteristics and uses of structures.

EQUIPMENT/SUPPLIES: Assignment sheets.

STANDARD OF PERFORMANCE: At least five general characteristics of construction and manufacturing will be used in the comparison, and eight structures will be classified with 75% accuracy.

REFERENCES

TEACHER	STUDENT
1. Recommended Exploring Construction, Chapter 2, "What is Construction Technology?"	1. Recommended Exploring Construction, Chapter 2, "What is Construction Technology?"

ACTIVITIES

TEACHER	STUDENT
1. Make brief presentation highlighting the similarities and differences between construction and manufacturing. Similarities: Both produce products. Both use manpower, materials, and tools. Differences: Size of products The location of the work (factory vs. on-site) Dependence of construction on money market.	

TEACHER	STUDENT
2. Using chalkboard or overhead projector, present definitions and characteristics of various types of construction.	2. Listen, discuss, take notes.
3. Hand out assignment sheet (attached) and have students classify the structures listed.	3. Classify the structures listed by writing the appropriate category in the blank provided.
4. Collect papers to be checked later.	

Assignment Sheet
TYPES OF CONSTRUCTION

It is difficult to classify the types of activities or the structures which are produced by construction, but there are a lot of terms which are commonly used to designate or identify various types of construction. These are defined below:

Building /non-building construction: A structure which encloses a space, usually with walls, floors and roofs, is a building. Many structures such as highways, fences, dams, and bridges do not enclose space and are therefore not building construction.

Light/heavy construction: Structures which involve small quantities of material and result in a small finished product are light construction. The term is most often applied to smaller buildings such as houses, but other structures such as fences, small restaurants, service stations, etc., are also light construction. Structures which require great quantities of material and consequently result in a larger structure fall into the heavy construction category. Heavy construction is used mainly to refer to large buildings, but other large structures could also fall into this category.

Residential construction: May be either light or heavy construction, including both single-family and multi-family housing, ranging from a small house to a high-rise apartment building.

Commercial construction: Nonresidential building construction; includes such buildings as stores, warehouses, and office buildings. It may also be either light or heavy construction, because some stores and offices occupy quite small buildings.

Industrial construction: Mainly non-building structures such as power plants, refineries, docks, and some factories. It is practically all heavy construction.

Civil or Engineered construction: Consists mostly of highway, airport, and dam construction, but other structures such as bridges and sewage treatment facilities can also be included in this category. Again, it is mostly heavy construction.

When a single structure is classified as to type of construction, it is obvious that more than one of the terms discussed above may apply. A house, for instance, is light residential construction, whereas a high-rise office building is heavy commercial construction. Classify each of the examples below, using all of the terms that apply in each case.

Structure	Classification
A high school for 2,000	_____
A Convenient Food Mart	_____
A bank in your town	_____
A new city park	_____
A by-pass around the city	_____
A duplex apartment building	_____
A 20-story office building	_____
A 16-unit apartment complex	_____

Construction and manufacturing are alike in some ways, but different in others. List as many similarities and differences as you can.

SIMILARITIES:

_____

_____

_____

DIFFERENCES:

_____

_____

_____

PERFORMANCE OBJECTIVE (3 days)

TASK/COMPETENCY: (COS-006) Identify and classify structures according to the structural system used.

EQUIPMENT/SUPPLIES: Assignment sheet

STANDARD OF PERFORMANCE: Eight structures will be classified with at least 75% accuracy, based on the textbook and assignment sheet information.

REFERENCES

TEACHER	STUDENT
1. Recommended Exploring Construction, Chapter 2, "What is Construction Technology?" 2. Suggested World of Construction, Readings 34-37, "Building Superstructures."	1. Recommended Exploring Construction, Chapter 2, "What is Construction Technology?"

SELECTED INSTRUCTIONAL MATERIALS: 16mm films or videocassettes, "Wood Frame", "Reinforced Concrete", "Structural Steel", Aries Films, 4125 NW Place, Gainesville, Florida 32605.

ACTIVITIES

TEACHER	STUDENT
1. Show films (one or more). If two or three films are shown, two or three class periods will be required.	1. View films.
2. In lieu of showing films, have students do the supplementary activity, "Structural Systems".	2. Complete activity as instructed.

TEACHER	STUDENT
3. Have students complete Assignment Sheet COS-006, "Structural Systems".	3. Complete assignment sheet.

Supplementary Activity COS-006

STRUCTURAL SYSTEMS
(2 days)

INTRODUCTION: One of the most common structural systems is the frame. In this activity, you will see how frame members can be put together in different ways to achieve different results, and you will build a model dome frame.

EQUIPMENT AND SUPPLIES: Domekit I and Dome Discovery Handbook, distributed by Transtech Systems (see Appendix C). One kit (includes handbook) for every two or three students is best.

ACTIVITIES

TEACHER	STUDENT
1. Divide the class into groups of 2 or 3 students.	1. Note with whom you will be working.
2. Distribute materials to each group.	
3. Demonstrate how parts are used, and instruct students to follow the instructions in the handbook.	3. Following instructions in handbook, assemble each shape and have your instructor check it before going on to the next one.
4. Have students complete Assignment Sheet COS-006, "Structural Systems", and turn it in to be checked.	4. Identify structures which fit the categories of superstructures.

Assignment Sheet
COS-006

STRUCTURAL SYSTEMS

The previous lesson dealt with the classification of construction according to the characteristics and uses of the structures. Still another way to classify structures is by the structural systems used for the superstructure. The categories generally used in this classification are mass, solid wall, frame, and air-supported. For each of these categories, list two structures you have seen or have seen pictures of which fit into the category.

	Structure
Mass	_____
	_____
Solid Wall	_____
	_____
Frame	_____
	_____
Air-supported	_____
	_____

CONSTRUCTION PLANNING AND MANAGEMENT

PERFORMANCE OBJECTIVE (1 day)

TASK/COMPETENCY: (COS-007) List the main purposes of community planning.

EQUIPMENT/SUPPLIES: Assignment sheet.

STANDARD OF PERFORMANCE: At least four purposes shall be listed with 75% accuracy, according to the information presented in the assignment sheet and class lecture.

REFERENCES

TEACHER	STUDENT
2. Suggested World of Construction, Reading 58, "City and Regional Planning." Exploring the Construction Industry, Concept 6, "Community Planning."	2. Suggested World of Construction, Reading 58, "City and Regional Planning."

SELECTED INSTRUCTIONAL MATERIALS: Assignment sheet (attached), copy of local zoning regulations, examples of building codes (National Electrical Code, State Plumbing Code, etc.).

ACTIVITIES

TEACHER	STUDENT
NOTE: If Activity packet for available, Activity 4A may be	Exploring Construction is substituted for this activity.
1. Introduce the topic of community planning by discussing the relationship between construction and community needs. Any community has needs, and	1. Listen, discuss, take notes.

TEACHER	STUDENT
in order to meet those needs, structures must be built. Examples: Need for transportation--Roads, bridges, etc. Need for government--Office buildings, courthouse, etc. Need for health care--Hospitals, doctor's office. In order for needs to be met effectively, the structures must be located properly, which requires community planning.	
2. Discuss the meaning of and reasons for zoning and building codes.	2. Listen, discuss, take notes.
3. Hand out Assignment Sheet COS-007, "Community Planning," and instruct the class regarding its completion.	3. Make sure instructions are clear.
4. Have students complete the assignment sheet and turn it in.	4. Answer all questions on assignment sheet and turn it in.

Assignment Sheet COS-007
COMMUNITY PLANNING

DIRECTIONS: Using the zoning regulations and your class notes, answer each of the following questions.

1. What is the purpose of zoning? _____

_____

_____

2. What are the names of the zones used in your community?
(a)_____ (b)_____
(c)_____ (d)_____

3. What is primary construction? _____

_____

4. List six needs met by primary construction and give an example from your community for each.

a. _____ _____

b. _____ _____

c. _____ _____

d. _____ _____

e. _____ _____

f. _____ _____

5. Laws which specify building practices in a community are _____. Their purpose is to _____

_____

PERFORMANCE OBJECTIVE (2 days)

TASK/COMPETENCY: (COS-008) List the factors to consider in the selection of a construction site.

EQUIPMENT/SUPPLIES: Site Rating Sheet, Purchase Agreement.

STANDARD OF PERFORMANCE: Four out of five factors will be listed accurately, according to the textbook.

REFERENCES

TEACHER	STUDENT
1. Recommended *Exploring Construction*, Chapter 5, "Obtaining the Site." 2. Suggested *World of Construction*, Reading 4, "Selecting and Purchasing A Site," and Reading 6, "Soil Testing." *Principles and Practices of Heavy Construction*, Chapters 1 and 2, "Site Investigation," and "Site Layout."	1. Recommended *Exploring Construction*, Chapter 5, "Obtaining the Site." *World of Construction*, Reading 4, "Selecting and Purchasing A Site," and Reading 6, "Soil Testing."

SELECTED INSTRUCTIONAL MATERIALS: Activity Sheet 5, *Exploring Construction* Activity packet.

ACTIVITIES

TEACHER	STUDENT
1. Give a brief presentation on "Obtaining the Site."	1. Listen, discuss, take notes.

TEACHER	STUDENT
2. Go over the Site Rating Sheet , Activity Sheet 5 in the Activities Packet.	
3. Allow students within a group to do their ratings individually and write an explanation for their ratings.	3. Work on ratings, write explanations.
4. Have students discuss their ratings and come to agreements on the ratings.	
5. Have them report their final decisions to the class and explain why they chose the site.	
6. Ask a realtor from your community to give a short presentation on "Buying Real Estate." Suggest to the speaker the points to cover in the talk. Provide the speaker with a time limit or give the presentation yourself.	
7. Provide students with the Purchase Agreement found in the Activities Packet.	
8. Go over the instructions on the back of the form.	
9. Help students complete the form when needed.	9. Complete the Purchase Agreement.

PERFORMANCE OBJECTIVE (1 day)

TASK/COMPETENCY: (COS-009) Explain the purpose and general concepts of surveying and mapping.

EQUIPMENT/SUPPLIES: None

STANDARD OF PERFORMANCE: The explanation should include one main purpose and at least three general concepts of surveying and mapping, as explained in class lecture and the textbook.

REFERENCES

TEACHER	STUDENT
1. Recommended Exploring Construction, Chapter 6, "Surveying the Site." 2. Suggested World of Construction, Reading 5, "Surveying and Mapping." Exploring the Construction Industry, Concept 5, "Surveying and Mapping for Community Planning."	1. Recommended Exploring Construction, Chapter 6, "Surveying the Site." 2. Suggested World of Construction, Reading 5.

SELECTED INSTRUCTIONAL MATERIALS: Filmstrip/cassette, "Introduction to Surveying and Mapping," Exploring the Construction Industry Series.

ACTIVITIES

TEACHER	STUDENT
1. Introduce topic by explaining the relationship between surveying and mapping and construction.	
2. Show filmstrip/cassette.	2. View filmstrip/cassette.
3. Summarize purpose of surveying and mapping (to locate natural and artificial features of a site). Note that an architect or engineer always starts with the site plan when designing a structure.	3. Listen, discuss.
4. Summarize general concepts of surveying and mapping.	4. Listen, discuss.
5. Have students write a paragraph explaining the purpose and general concepts of surveying and mapping, or complete an assignment sheet of your making.	

PERFORMANCE OBJECTIVE (1 day)

TASK/COMPETENCY: (COS-010) Identify the tools and instruments used by surveyors.

EQUIPMENT/SUPPLIES: Transit, tripod, surveyor's chain, range pole, level rod.

STANDARD OF PERFORMANCE: The tools and instruments shall be identified with the names used in the textbook with at least 75% accuracy.

REFERENCES

TEACHER	STUDENT
1. Recommended Exploring Construction, Chapter 6, "Surveying the Site." 2. Suggested World of Construction, Reading 5, "Surveying and Mapping." Exploring the Construction Industry, Concept 5, "Surveying and Mapping for Community Planning."	1. Recommended Exploring Construction, Chapter 6, "Surveying the Site." World of Construction, Reading 5, "Surveying and Mapping."

SELECTED INSTRUCTIONAL MATERIALS: Transit, tripod, surveyor's chain, range pole, level rod.

ACTIVITIES

TEACHER	STUDENT
1. If a guest surveyor can come to the class, introduce him/her to the class and explain what is to be done during the class period. If no guest is available, borrow equipment for the demonstration, and proceed as follows:	
2. Identify the transit and tripod. Mount transit on tripod. Locate transit over a point. Level transit.	2. Observe demonstration.
3. Demonstrate the use of the telescope, then have students take turns looking through it to find a point (use range pole or stake).	3. Locate range pole or stake through telescope.
4. Explain and demonstrate the use of the transit for determining elevation and angle. A rectangle can be laid out on the laboratory floor or parking lot using a chalkline after points have been located. Have students do as much of the measuring and marking as possible.	4. Observe demonstration, assist as instructed.

PERFORMANCE OBJECTIVE (3 days)

TASK/COMPETENCY: (COS-011) Explain the process of locating boundary lines for a building lot.

EQUIPMENT/SUPPLIES: (per group) 1 building site box, 1 monument block, 1 survey instrument, 1 sighting rule, 4-1/4" x 3" stakes (wood dowels pointed with pencil sharpener), 1 traversing information (refer to Exploring Construction Activities Packet), 1 Radial recording chart (Activities Packet).

STANDARD OF PERFORMANCE: Steps in the process will be listed in the sequence given by the textbook with 75% accuracy.

REFERENCES

TEACHER	STUDENT
1. Recommended Exploring Construction, Chapter 6, Surveying the Site," and Activity 6A, "Locating Boundary Lines," Instructor's Guide.	1. Recommended Exploring construction, Chapter 6, "Surveying the Site."

SELECTED INSTRUCTIONAL MATERIALS: Same as previously listed.

ACTIVITIES

TEACHER	STUDENT
NOTE: If surveying equipment is available to the class, a lot may be laid out in a parking lot or field near the school, instead of using the simulated equipment called for by the textbook.	
1. Demonstrate how to set up and use the instruments.	1. Observe demonstration.

TEACHER	STUDENT
a. A nail through the horizontal circle on the instrument holds it in place and on a "due north" bearing. b. Each mark on the bearing and sighting rule represents 1 foot. 2. Explain that 1/2" of the stake has to be sticking out of the soil. The survey instrument is set on it. 3. Describe the traversing method (Problem 1) to make the original survey. 4. Describe the radial method (Problem 2). It is used to check the original survey. 5. Assign students to groups of 3-5. They will play the role of a survey party. Assign the following titles: a. Party Chief--Plans and directs survey work. b. Instrument person--Sets the instrument and takes bearing readings. c. Tape person--Takes reading of distances. d. Rod person--Drives stakes. e. Recorder--Takes field notes. 6. You may want to have one survey party check the work of another.	5. Using the materials provided, lay out the boundary lines in the site box. 6. Report to instructor when work is complete.

PERFORMANCE OBJECTIVE (8 days)

TASK/COMPETENCY: (COS-012) Carry out the various steps in the design process for structures, including making a sketch of a small structure.

EQUIPMENT/SUPPLIES: Pencil, eraser, 1/4" grid paper 8 1/2" x 11", assignment sheet.

STANDARD OF PERFORMANCE: The completed sketch must conform to the criteria specified by the assignment sheet with at least 75% accuracy.

REFERENCES

TEACHER	STUDENT
1. Recommended Exploring Construction, Chapter 7, "Designing the Project." 2. Suggested World of Construction, Reading 7, "Designing and Engineering Constructed Works." Introduction to Construction, Chapter 2, "Architectural Drawing."	1. Recommended Exploring Construction, Chapter 7, "Designing the Project." 2. Suggested World of Construction, Reading 7, "Designing and Engineering Constructed Works."

SELECTED INSTRUCTIONAL MATERIALS: Assignment Sheet COS-012, "Designing a Fast-Food Restaurant."

ACTIVITIES

TEACHER	STUDENT
1. Have students complete reading assignment prior to this lesson. 2. Review the steps in the design process as de-	1. Complete reading assignment (Chapter 7, Exploring Const. 2. Listen, discuss

TEACHER	STUDENT
scribed in the textbook. 3. Describe the project for designing--Hand out Assignment Sheet COS-012. 4. Hand out paper and other supplies needed for the project. 5. Have students sketch a floor plan and elevations as specified on the assign ment sheet.	5. Sketch a floor plan and elevations as specified.

Assignment Sheet COS-012
DESIGNING A FAST-FOOD RESTAURANT

DIRECTIONS: Using the grid paper provided, sketch a floor plan, front elevation and one side elevation of a fast-food restaurant, given the following specifications:

1. The size of the building is to be 1400 square feet maximum.

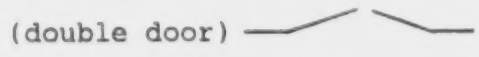
2. The plan must include seating for customers, an order/serving counter, food preparation area, storage area, two bathrooms, a drive-through, and parking for 30 cars.

3. Each square on the grid paper is 4' x 4'

4. Identify each item on your drawing by lettering names neatly. Include such items as tables, booths, serving counter, trash containers, etc.

5. Wood or masonry walls should be represented by a thick solid line, windows by a thin solid line. Doors should be shown as follows:

(single door)

(double door) 

PERFORMANCE OBJECTIVE (1 day)

TASK/COMPETENCY: (COS-013) Apply the general systems model to construction.

EQUIPMENT/SUPPLIES: None

STANDARD OF PERFORMANCE: At least three examples of inputs, processes, and outputs will be listed.

REFERENCES

TEACHER	STUDENT
2. Suggested World of Construction, Reading 1, "People and Technology" Exploring the Construction Industry, Concept 2, "Planning Construction"	2. Suggested World of Construction, Reading 1.

SELECTED INSTRUCTIONAL MATERIALS: Assignment sheet (attached)

ACTIVITIES

TEACHER	STUDENT
1. Discuss with the class the general idea of systems, and present the systems model.	1. Listen, discuss, take notes.
2. Illustrate a simple system by using some boards to make a frame or box. Explain the system as follows: Inputs--hammer, nails, boards, labor(effort in driving nails, holding boards, etc.)	2. Observe, listen, ask questions.

TEACHER	STUDENT
Processes--driving nails, checking for squareness. Outputs--box or frame.	
3. Apply the system to the construction of a house, emphasizing the great diversity of both inputs and processes.	3. Listen, discuss, take notes.
4. Give students Assignment Sheet COS-013,"Systems Model". Have them write examples of inputs, processes, and outputs.	4. Write example of construction inputs, processes, and outputs
5. When students have finished, make a composite list on the chalkboard as they read their lists. As different items are given, add them to the list. This should re-emphasize the great variety of inputs and processes necessary in construction, because the list will normally become quite long.	5. Read lists for instructor and rest of class.

Assignment Sheet COS-013

SYSTEMS MODEL

INTRODUCTION: The general concept of "systems", is that of several things working together to accomplish a goal or produce a result. This can be expressed,

INPUT > PROCESS > OUTPUT

which is interpreted as inputs which are processed to produce outputs. This general model can be applied to very simple or complex systems. In the spaces below, list several examples of inputs, processes, and outputs of construction.

INPUTS	PROCESSES	OUTPUTS

PERFORMANCE OBJECTIVE (1 day)

TASK/COMPETENCY: (COS-014) Describe some common types of contracts used in construction.

EQUIPMENT/SUPPLIES: None

STANDARD OF PERFORMANCE: At least two types of contracts will be described.

REFERENCES

TEACHER	STUDENT
1. Recommended Exploring Construction, Chapter 9, "Contracting," and Activity 9A, "Selecting the Kind of Contract," Instructor's Guide. 2. Suggested Exploring the Construction Industry, Concept 3, "Organizing Construction," Concept 4, "Controlling Construction," and Concept 13, "Estimating, Bidding, and Contracting."	1. Recommended Exploring Construction, Chapter 9, "Contracting."

SELECTED INSTRUCTIONAL MATERIALS: Activity Sheets 9A and 9B, Exploring Construction Activity Packet.

ACTIVITIES

TEACHER	STUDENT
NOTE: This activity, as well as the following two, can be related to a storage building or similar large project used for teaching other units in the course. 1. Give a brief presentation on the kinds of management and pricing used in contracts.	

TEACHER	STUDENT
2. Divide the class into design teams. They are now owners who are preparing to advertise for bids.	
3. Provide the group with Activity Sheets 9A and 9B.	
4. Ask them to decide on the kind of project management and pricing they want to use on their project.	4. Using the activity sheet, make decisions as indicated.
5. Have them present and support their decisions.	5. Present decisions to rest of class.
6. Remember, more than one decision may be acceptable.	

PERFORMANCE OBJECTIVE (3 days)

TASK/COMPETENCY: (COS-015) Estimate the cost of materials for a small structure.

EQUIPMENT/SUPPLIES: None

STANDARD OF PERFORMANCE: The estimate will be accurate within plus/minus 10% of a figure established by the instructor.

REFERENCES

TEACHER	STUDENT
1. Recommended Exploring Construction, Chapter 9, "Contracting," and Activity 9B, "Estimating Cost of Clubhouse," Instructor's Guide. 2. Suggested Exploring the Construction Industry, Concept 13, "Estimating, Bidding, and Contracting."	1. Recommended Exploring Construction, Chapter 9, "Contracting."

SELECTED INSTRUCTIONAL MATERIALS: Sets of plans for the storage building or other structure which will be built by the class, sets of estimation sheets which have been partially completed by instructor, and a price schedule with prices of the materials which are required for the project.

ACTIVITIES

TEACHER	STUDENT
1. Give a brief presentation on estimating and bidding. 2. Hand out copies of plans and estimation sheets. NOTE: The estimation sheets	

TEACHER	STUDENT
may be partially completed by the instructor, the exact amount of work left to be done by students can be adjusted as desired. 3. Explain what is to be done to complete the materials estimate, called the "materials takeoff." This will necessitate some time spent explaining the construction of the building. In order for students to make an accurate estimate, they must know how the structure is built, the names of the various parts, etc. 4. Have students work on the estimate.	4. Using the plans, price schedule, and estimation sheet, list the quantities of each type of material needed and calculate the cost of the structure.

PERFORMANCE OBJECTIVE (2 days)

TASK/COMPETENCY: (C0S-016) Prepare a schedule for the construction of a small structure.

EQUIPMENT/SUPPLIES: None

STANDARD OF PERFORMANCE: The schedule will contain all the activities planned for the project. The amount of time allowed for each activity will be 75% accurate based on criteria established by the instructor.

REFERENCES

TEACHER	STUDENT
1. Recommended Exploring Construction, Chapter 10, "Managing Construction," and Activity 10A, "Scheduling the Project," Instructor's Guide.	1. Recommended Exploring Construction, Chapter 10, "Managing Construction."

SELECTED INSTRUCTIONAL MATERIALS: A bar chart form with days and weeks marked, and the various categories of activities listed. (Example: build floor frame-2 days; apply plywood subfloor--1 day).

ACTIVITIES

TEACHER	STUDENT
1. Give a brief presentation on scheduling. 2. Hand out copies of bar chart forms, and explain how they are to be used. Remind students that time will be required for instruction, tests, etc. Give them exact information in this regard insofar as possible.	

TEACHER	STUDENT
3. Divide class into groups of 3-5 students.	
4. Have groups work on schedules.	4. Draw bars representing the time to be spent on each activity.
5. Have groups report results to the class.	5. Report results to the class.
6. After discussing the results with the whole class, the instructor may prepare a large version of the bar chart to be posted on the wall so that progress can be checked at any time.	

PERFORMANCE OBJECTIVE (1 day)

TASK/COMPETENCY: (COS-017)Apply for a building permit

EQUIPMENT/SUPPLIES: None

STANDARD OF PERFORMANCE: The application will be completed with 100% accuracy.

REFERENCES

TEACHER	STUDENT
1. Recommended Exploring Construction, Chapter 14, "Preparing to Build," and Activity 14A, "Applying for a Building Permit."	1. Recommended Exploring Construction, Chapter 14, "Preparing to Build."

SELECTED INSTRUCTIONAL MATERIALS: Copies of building permit applications, blank or void permit, and Stop Work order.

ACTIVITIES

TEACHER	STUDENT
1. Give a brief presentation on "Getting Building Permits."	
2. Set the stage so that your students play the role of contractor. They need to complete the application for a building permit to build the structure that has been selected for the class.(storage building, playhouse, etc.)	
3. They will need to submit a site plan and a floor plan with the application so that the placement of the	3. Complete the application and turn it in to instructor.

TEACHER	STUDENT
structure and size of the structure can be approved. 4. The teacher plays the role of building commissioner. Complete and sign the building permit found on the back of the application in the Activities Packet.	

PERFORMANCE OBJECTIVE (1 day)

TASK/COMPETENCY: (COS-018) List some of the factors to be taken into account when clearing a construction site.

EQUIPMENT/SUPPLIES: Site box, model pine trees, hardwood trees, aluminum foil, blocks of wood and paper tubes to simulate existing structures, sand and stone for rock piles and boulders.

STANDARD OF PERFORMANCE: At least four factors will be listed correctly.

REFERENCES

TEACHER	STUDENT
1. Recommended Exploring Construction, Chapter 14, "Preparing to Build," and Activity 14B, "Clearing the Site."	1. Recommended Exploring Construction, Chapter 14, "Preparing to Build."

SELECTED INSTRUCTIONAL MATERIALS: Same as previously listed.

ACTIVITIES

TEACHER	STUDENT
1. Give a brief presentation on "Clearing the Site." 2. Divide your class into work crews that have to clear their site. 3. Describe the building sites to the work crews. Their task is to decide how they are to clear the site. 4. The workers must decide if they will wreck or salvage the structures, and destroy	

TEACHER	STUDENT
or salvage trees and brush and if they will dispose of or salvage soil, stones, and boulders on the site. What are the resale values for 6 in. and 10 in. trees and clean topsoil?	
5. Have the work crews discuss the site clearing problems and fill in the chart.	
6. Have each crew decide what equipment (bought or rented) will minimize the cost of site clearing, and at the same time reduce the labor cost. The labor cost involves time spent and also expense for special experience.	
7. Supervise student's work.	7. Select one obstacle on one site at a time. Write the name on the chart found in the Activity Sheet. Fill out the line to the right. Decide why it was removed, how it was done, and what equipment was used.

PERFORMANCE OBJECTIVE (1 day)

TASK/COMPETENCY: (COS-019) Describe the process for locating a structure on a site.

EQUIPMENT/SUPPLIES: (per group) Building site box, 5 layout lines (30" long), 4 stakes (1/4"x1/4"x3" with pointed ends), 10 to 12 1 1/2" wire brads or nails, sighting rule, hammer.

STANDARD OF PERFORMANCE: The steps in the process will be listed in sequential order with 75% accuracy.

REFERENCES

TEACHER	STUDENT
1. Recommended Exploring Construction, Chapter 14, "Preparing to Build," and Activity 14C, "Locating the Structure." 2. Suggested Principles and Practices of Heavy Construction, Chapter 2, "Site Layout." Principles and Practices of Residential Construction, Chapter 6, "Staking Out."	1. Recommended Exploring Construction, Chapter 14, "Preparing to Build." 2. Suggested

SELECTED INSTRUCTIONAL MATERIALS: Same as previously listed.

ACTIVITIES

TEACHER	STUDENT
1. Give a brief presentation on "Locating Structures." 2. Demonstrate the "center	

TEACHER	STUDENT
baseline" method described in the text and used in Activity Sheet 14C.	
3. Important: Inform the civil engineers (students) that nails are to be placed in the sides of the building site boxes. In our simulation, the nails are placed off of the building site. This practice is seldom used in actual practice. However, in this miniaturized simulation, the batter boards would be too small and weak to hold nails. Therefore, we are extending the building lines out to the sides of the building site boxes.	
4. Supervise student's work.	4. Adjust the lines until they are in the exact position. Then mark the edges of the building site box.
5. Supervise student's work.	5. Drive nails into the sides of the box at both marks. If nails are driven into the sides, the boxes can be stacked without removing the nails.
6. Supervise student's work.	6. Stretch a line between the nails.
7. Supervise student's work.	7. Follow this procedure for all four building lines.
8. Supervise student's work.	8. Measure the diagonals of the structure. They should be of equal length.

PERFORMANCE OBJECTIVE (2 days)

TASK/COMPETENCY: (COS-020) List the factors to consider in preparing a construction site.

EQUIPMENT/SUPPLIES: Site box for each group, wood cut to sizes as follows: 1/2"x1/2"x3/4", 3/4"x1"x2 1/2", 3/4"x 3"x4", 3/4"x1 1/2"x30", 3/4"x1"x2", 3/4"x2"x2", 3/4"x6"x8".

STANDARD OF PERFORMANCE: At least four factors will be listed correctly, according to the textbook.

REFERENCES

TEACHER	STUDENT
1. Recommended Exploring Construction, Chapter 14, "Preparing to Build," and Activity 14D, "Preparing the Site."	1. Recommended Exploring Construction, Chapter 14, "Preparing to Build."

SELECTED INSTRUCTIONAL MATERIALS: Same as previously listed.

ACTIVITIES

TEACHER	STUDENT
1. Give a brief presentation on "Preparing the Site."	
2. Divide the class into engineering groups from the home office.	
3. Describe how the site planning models are to be used to plan the site.	
4. Encourage them to have all areas as accessible to the work area as they can and to have storage areas adjoined to the access road.	4. Prepare the site, using the site box and the models provided.

TEACHER	STUDENT
5. Supervise student's work.	5. When the site is finished, present the plan to the instructor for approval.

PERFORMANCE OBJECTIVE (2 days)

TASK/COMPETENCY: (COS-021) Describe a method of doing earthwork to prepare a site for building.

EQUIPMENT/SUPPLIES: Building site box with structure staked out, hammer, 8 layout lines (30" long), 10 pcs. band iron 1/8"x3/8"x4", 10 pcs. pine 1/8"x1/2"x3", 20 pcs. pine 1/8"x1/2"x2 1/2", 12" rule, straightedge at least 24" long, 8-10 4d box nails, wood 1 1/2"x1 1/2"x6", 48" of 1/2" EMT conduit, 5/8" diameter dowel 1/2" long, hand brace, tubing cutter, 12' rule.

STANDARD OF PERFORMANCE: The description will include at least 75% of the steps involved in a particular method.

REFERENCES

TEACHER	STUDENT
1. Recommended Exploring Construction, Chapter 15, "Doing Earthwork," and Activities 15A-15D, Instructor's Guide.	1. Recommended Exploring Construction, Chapter 15, "Doing Earthwork."
2. Suggested Underground, by David MacCauley.	2. Suggested Underground, by David MacCauley.

SELECTED INSTRUCTIONAL MATERIALS: Backhoe shovel, soil boring tool, caisson--all from Appendix A, Exploring Construction Instructor's Guide. Soil Profile from the Making Soil Surveys Activity.

ACTIVITIES

TEACHER	STUDENT
NOTE: This is a four-in-one activity. Different groups of students will be working on four variations of the activity simultaneously.	
1. Give a brief presentation on "Doing Earthwork." Mention special requirements, such as avoiding existing utility lines underground.	
2. Briefly describe each structure, its use, and the kind of excavation to make.	
3. Assign the work crews to their project.	
4. Refer each crew to the instructions for their problem in the Activity Sheet.	
5. Supervise student's work	5. Estimate how much material will be removed. A cost for removal, such as $200 per cubic inch, can be set.
6. Supervise student's work	6. Carry out the excavation as directed.
7. When all excavations are complete, ask the supervisor from each group to describe that group's excavating experience. They should go over the "Excavation Plan" they completed in the Activity Sheet to describe what they did. Then they can discuss problems they had or alternatives.	7. Describe the experience of your group.

PERFORMANCE OBJECTIVE (2 days)

TASK/COMPETENCY: (COS-022) Name the utilities needed for construction work and for structures.

EQUIPMENT/SUPPLIES: None

STANDARD OF PERFORMANCE: The utilities needed will be described with 75% accuracy, according to the textbook.

REFERENCES

TEACHER	STUDENT
2. Suggested World of Construction, Reading 38, "Installing Utilities-Outside." Principles and Practices of Residential Construction, Chapter 3, "Site Utilities."	2. Suggested World of Construction, Reading 38, "Installing Utilities-Outside."

ACTIVITIES

TEACHER	STUDENT
1. Make a short presentation on the need for and types of utilities, and how they are used in structures.	
2. Discuss which utilities are needed during building, and why.	2. Participate in discussion.
3. Take the class around the school building and point out where the building is connected to the water, electrical, and gas systems. Discuss the reasons for placing utilities in certain ways. (Water-	3. Observe various components of utility systems.

TEACHER	STUDENT
underground to prevent freezing. Electricity-overhead or underground for safety).	
4. Follow the utility systems through the building as far as possible. Get permission to enter mechanical rooms or basement areas where pipes and other components are visible. Instruct students regarding safety before entering restricted areas.	4. Observe the components of the utility systems.

PERFORMANCE OBJECTIVE (1 day)

TASK/COMPETENCY: (COS-023) Explain the purpose and function of foundations.

EQUIPMENT/SUPPLIES: 1 brick; 1 claw hammer; 1 board 1x6x12"; 1 sponge 2x6x10"; 4 8d common nails; 1 site box(or tray) with 2" of moist sand; 1 sheet metal "foundation wall"(teacher-prepared); 1 wood "spread footing" 4 3/4"x4 3/4"(teacher-prepared); 1 pc. plywood 3/8x5x5" ("floating footing")

STANDARD OF PERFORMANCE: The purpose and function of foundations will be described with 75% accuracy, according to the information presented in class.

REFERENCES

TEACHER	STUDENT
1. Recommended Exploring Construction, Chapter 16, "Building Foundations." 2. Suggested World of Construction, Reading 31, and Assignment 101, Quad III, Teacher's Guide Principles and Practices of Residential Construction, Chapter 8, Prentice-Hall, Inc. Principles and Practices of Heavy Construction, Chap. 5, Prentice-Hall, Inc.	1. Recommended Exploring Construction, Chapter 16, "Building Foundations." 2. Suggested Underground, by David MacCauley.

SELECTED AUDIOVISUAL MATERIALS: Filmstrip/cassette, "Building Foundations", World of Construction series.

ACTIVITIES

TEACHER	STUDENT
1. Show FS/Cass, "Building Foundations"	2. View filmstrip.
3. Discuss with class the concepts and terms relevant to foundations: Bearing surface, footings, dead and live loads, frost line, foundation wall.	3. Listen, discuss, take notes.
4. Demonstrate function of different types of footings using the activities from pp.181-184 of the World of Construction Teacher's Guide.	4. Observe demonstration.
5. Have students write a brief explanation of the function of foundations.	5. Write a brief explanation of the function of footings.

PERFORMANCE OBJECTIVE (1 day)

TASK/COMPETENCY: (COS-024) Identify the materials and components used in foundations.

EQUIPMENT/SUPPLIES: None

STANDARD OF PERFORMANCE: The footing, foundation wall, reinforcement, and piling should be identified correctly, and at least one material should be listed for each component.

ENABLING OBJECTIVE: Read a simple drawing of a foundation cross-section.

REFERENCES

TEACHER	STUDENT
1. Recommended Exploring Construction, Chapter 16, "Building Foundations." 2. Suggested World of Construction, Reading 31, "Setting Foundations." Principles and Practices of Residential Construction, Chapter 8, "Foundations." Principles and Practices of Heavy Construction, Chapter 5, "Foundations."	1. Recommended Exploring Construction, Chapter 16, "Building Foundations." 2. Suggested

SELECTED INSTRUCTIONAL MATERIALS: Film, "The Foundation", by Circle Oak Productions, drawing of footing and foundation cross-sections.

ACTIVITIES

TEACHER	STUDENT
1. Show film, "The Foundation" to class.	1. View film.
2. Discuss with class the various components and materials used in foundations: Footings, foundation walls, piling, reinforcement, concrete, concrete block, brick, steel and wood piling.	2. Listen, discuss, take notes.
3. Have students identify the components on a drawing of a foundation cross-section, and list one or more materials which could be used for each.	3. Identify components and materials on drawing.

PERFORMANCE OBJECTIVE (3 days)

TASK/COMPETENCY: (COS-025) Build a simple form for a footing section.

EQUIPMENT/SUPPLIES: 1 portable electric drill, 1 1/8" twist drill, 1 tape or folding rule, 1 try square, 1 claw hammer, 1 pencil, 1 crosscut saw, 5 nail aprons, 1 pc. wood 1 x 3 x 51"(to be cut for footing form sides), 1 pc. plywood, 1/2 x 15 1/2 x 48" (base), 1 sheet 15-lb building felt or plastic sheet 16 x 48", 24 6d common or box nails, 4 corner blocks, 8 4d finish nails. (Note: The equipment and supplies are the quantities necessary for one group.)

STANDARD OF PERFORMANCE: The form will be within 1/8" of the dimensions specified.

REFERENCES

TEACHER	STUDENT
1. Recommended Exploring Construction, Chapter 16, "Building Foundations," and Activity 16C, "Building Spread Footings." 2. Suggested World of Construction, Reading 32, "Building Forms and Setting Reinforcement." Principles and Practices of Residential Construction, Chapter 8, Prentice-Hall. Principles and Practices of Heavy Construction, Chapter 6, Prentice-Hall.	1. Recommended Exploring Construction, Chapter 16, "Building Foundations." 2. Suggested World of Construction, Reading 32, "Building Forms and Setting Reinforcement."

SELECTED INSTRUCTIONAL MATERIALS: Same as previously listed plus drawings of footing forms to be built, if different than those in Exploring Construction Instructor's Guide.

ACTIVITIES

TEACHER	STUDENT
NOTE: This activity may be done for the structure illustrated in the Exploring Construction Instructor's Guide, or for another structure selected by the instructor.	
1. Demonstrate use of tools for cutting, laying out, and nailing boards together.	1. Observe demonstration.
2. Divide class into groups of three to five students.	
3. Have students build forms, using the drawings provided.	3. Cut boards to length.
4. Supervise student's work.	4. Nail boards together.
5. Demonstrate cutting and placing reinforcement.	5. Place form on plastic, check for squareness, cut and place reinforcement.

PERFORMANCE OBJECTIVE (2 days)

TASK/COMPETENCY: (C0S-026)Mix and place concrete.

EQUIPMENT/SUPPLIES: Mortar box, hoe and shovel, wood straightedge(screed), magnesium or wood float, steel finishing trowel, measuring cup, 2' steel rod or 1 x 1 x 2' wood stick, footing form (from previous activity), 16 oz paper cup (for slump test), portland cement, sand, gravel, plastic sheet 3' x 6' or larger, anchor bolts and nuts, 8 4" loop-end tie wires, 8 ft.of no. 3 rebar.

STANDARD OF PERFORMANCE: Each student will participate in each step of the task, as specified below.

REFERENCES

TEACHER	STUDENT
1. Recommended Exploring Construction, Chapter 16, "Building Foundations," and Activity 17A, "Building Mass Structures." 2. Suggested World of Construction, Reading 33, "Mixing, placing, and Finishing Concrete." Principles and Practices of Heavy Construction, Chapter 7, "Concrete Work." Materials for Construction, Chapter 3, "Concrete."	1. Recommended Exploring Construction, Chapter 16, "Building Foundations." 2. Suggested

SELECTED AUDIOVISUAL MATERIALS: Filmstrip/cassette, "Understanding Masonry", World of Construction series.

ACTIVITIES

TEACHER	STUDENT
1. Show filmstrip	1. View filmstrip.
2. Give demonstration on mixing and placing concrete.	2. Observe demonstration.
3. Divide class into groups of 3-5 students.	
4. Supervise student's work.	4. Mix and place concrete in forms.
5. Supervise student's work tools when finished.	5. Finish surface of concrete with wood or magnesium float.
6. Make sure time is allowed for cleaning tools.	6. Clean tools thoroughly.

PERFORMANCE OBJECTIVE (2 days)

TASK/COMPETENCY: (COS-027)Build a concrete block or brick wall section.

EQUIPMENT/SUPPLIES: 2 brick trowels, 1 3/8" jointing tool, 1 masonry level, 1 rule or measuring tape, 1 mortarboard, 4 one-corner concrete blocks (8"x8"x8"), 12 double-corner concrete blocks (8"x8"x16"), 11 stretcher blocks (8"x8"x16"), building felt or plastic, 2 bags pre-mixed mortar, mortar box, mixing hoe, 2 anchor bolts with nut and washer.

STANDARD OF PERFORMANCE: The demonstrated procedure will be followed at least 75% correctly.

REFERENCES

TEACHER	STUDENT
1. Recommended Exploring Construction, Chapter 17, "Building Superstructures," and Activity 17B, "Building Bearing Wall Structures." 2. Suggested World of Construction, Reading 34, "Building Mass and Solid Wall Superstructures." Principles and Practices of Heavy Construction, Chap. 13, "Masonry Construction."	1. Recommended Exploring Construction, Chapter 17, "Building Superstructures."

SELECTED INSTRUCTIONAL MATERIALS: Filmstrip, "Foundations", Exploring The Construction Industry series.

ACTIVITIES

TEACHER	STUDENT
1. Show the work crews how to lay out the walls. See Fig. 2-5 in Instructor's Guide.	1. Observe demonstration.
2. Demonstrate mixing the mortar. Note: By adding sugar to the mortar, it becomes easy to remove the mortar from the block. The blocks can therefore be reused.	2. Observe demonstration.
3. Demonstrate laying block. Follow the steps shown in the Activity sheet.	3. Observe demonstration.
4. Demonstrate tooling the joints.	4. Observe demonstration.
5. Assign students to work crews.	
6. Assign one crew to each corner of the structure.	6. Mix mortar.
7. Supervise student's work.	7. Lay block according to instructions, checking for level, straightness, and plumb.
	8. Remember to put the anchor bolts in the top of the wall and the sides of the window and doorway.

EVALUATION CRITERIA: Instructor will observe each student's performance and note whether each step was followed correctly.

SUPERSTRUCTURES

PERFORMANCE OBJECTIVE (1 day)

TASK/COMPETENCY: (COS-028) Define, identify types, and list the components of superstructures.

EQUIPMENT/SUPPLIES: None

STANDARD OF PERFORMANCE: The components of superstructures will be defined with 75% accuracy, according to the textbook.

REFERENCES

TEACHER	STUDENT
1. Recommended Exploring Construction, Chapter 17, "Building Superstructures." 2. Suggested World of Construction, Reading 34, "Building Mass and Solid Wall Superstructures."	1. Recommended Exploring Construction, Chapter 17, "Building Superstructures." 2. Suggested World of Construction, Reading 34, "Building Mass and Solid Wall Superstructures."

SELECTED INSTRUCTIONAL MATERIALS: "Identifying Superstructures," World of Construction series, and/or "Understanding Superstructures," Exploring the Construction Industry series filmstrip/cassettes.

ACTIVITIES

TEACHER	STUDENT
1. Give brief introduction by relating superstructures and substructures (foundations)	
2. Show filmstrip/cassette.	2. View filmstrip.
3. Discuss the components of the various types of superstructures--note that some	3. Participate in discussion.

TEACHER	STUDENT
superstructures are buildings and some are not. A building usually has floors, walls, and a roof, whereas a bridge may have only a floor and supporting framework.	

PERFORMANCE OBJECTIVE (2 days)

TASK/COMPETENCY: (COS-029) Describe the function and list the components and materials used in floor, wall, and roof systems.

EQUIPMENT/SUPPLIES: None

STANDARD OF PERFORMANCE: The function and components of floor, wall, and roof systems will be described with 75% accuracy according to the textbook and class lectures.

REFERENCES

TEACHER	STUDENT
1. Recommended Exploring Construction, Chapter 17, "Building Superstructures." 2. Suggested Principles and Practices of Residential Construction, Chaps. 9-13, "Framing Floors, Walls, and Roofs; Roof Covering." Principles and Practices of Heavy Construction, Chaps. 8-12, "Timber, Concrete, and Steel Frames; Floor and Roof Systems."	1. Recommended Exploring Construction, Chapter 17, "Building Superstructures."

SELECTED INSTRUCTIONAL MATERIALS: Film, "The Wood Shell" (If available).

ACTIVITIES

TEACHER	STUDENT
1. Introduce the topic by explaining that the object of the lesson is to examine various components of superstructures and the materials used.	
2. If available, show film.	2. View film.
3. If film not available, proceed with lecture/ discussion, following the attached outline.	
4. After film, cover items from attached outline which were not mentioned in film.	

SUPERSTRUCTURES

I. Floor Systems

A. Function of floors
1. Support contents of building
2. Structural tie between walls
3. Space for pipes, wires, and other utilities

B. Types, components and materials
1. Wood-frame floor systems
a. Girder
b. Sill plate
c. Floor joists
d. Joist header
e. Bridging
f. Subfloor
g. Underlayment
h. Finish floor
2. Metal-frame floor
a. Girder--Usually a wide-flange or I-beam (W or S shape).
b. Beams--Serve the same function as joists. S or W shapes common, also open-web or bar joists.
c. Deck--Corrugated steel most often used as a base for concrete floor.
d. Floor--Concrete most common, any type of finish floor possible.
3. Concrete floor system--May be precast or cast in place.
a. Slab-on-grade
b. Solid flat slab
c. Ribbed slab
d. Waffle slab
e. Finish floor

II. Wall Systems

A. Function of walls
1. Support floor and roof loads
2. Provide base for attachment of interior and exterior finish materials
3. Provide space for pipes, wires, and other utilities.
4. Enclose space and protect from weather

B. Types of walls
1. Load-bearing
2. Curtain walls (partition walls)

C. Components and materials
1. Wood-frame

a. Plates, studs
b. Headers
c. Sheathing
d. Insulation
e. Vapor barrier
f. Interior wall covering
g. Exterior finish

2. Metal-frame
a. Columns
b. Wall girts
c. Cross-bracing
d. Light metal framing--uses metal equivalents of wood-frame members.

3. Concrete or masonry walls
a. Cast-in-place concrete
b. Pre-cast concrete--mention tilt-up construction
c. Concrete block
d. Brick or stone--Solid or veneer

III. Roof Systems

A. Function of roof
1. Protects from weather
2. May provide space for utilities
3. May provide support for mechanical equipment (heating and air-cond.)

B. Types of roof systems (by shape)
1. Flat
2. Sloped
3. Curved

C. Types of roof systems (by material and construction)
1. Wood-frame
a. Ceiling joists and rafters
b. Trusses
2. Metal-frame
a. Bar-joists(open-web)
b. Metal trusses
3. Concrete
a. Pre-cast slab
b. Cast-in-place slab
4. Air-supported

D. Roof decks
1. Plywood
2. Tongue-and-groove solid wood decking
3. Corrugated steel
4. Concrete

F. Roofing
   1. Built-up roof--traditional
   2. Elastomeric roofing--new rubber-like materials have replaced traditional built-up roofing to a large extent.
   3. Shingles--wood, asphalt/fiberglass, metal, slate

PERFORMANCE OBJECTIVE (4 days)

TASK/COMPETENCY: (COS-030) Build a wood-frame floor system

EQUIPMENT/SUPPLIES: Portable electric circular saw or radial arm saw, 25'and 12' tapes, framing square, claw hammer, 4' level, chalkline, pencils.

STANDARD OF PERFORMANCE: The floor will be level, and have no more than 1/4" difference in diagonal measurements.

ENABLING OBJECTIVE: Use an electric circular saw or radial arm saw to cut boards to length; use chalkline; drive nails.

REFERENCES

TEACHER	STUDENT
1. Recommended Exploring Construction, Chapter 17, "Building Superstructures." 2. Suggested World of Construction, Reading 37, "Building Wood Frames." Principles and Practices of Residential Construction, Chap. 9, "Floor Framing."	1. Recommended Exploring Construction, Chapter 17, "Building Superstructures."

SELECTED INSTRUCTIONAL MATERIALS: Same as previously listed, needed for demonstrations.

ACTIVITIES

TEACHER	STUDENT
NOTE: This activity, along with COS-031 and COS-032, will be carried out in building a storage building, playhouse, or other small structure which will be sold to someone in the community when finished. The alternate activities from the Exploring Construction Instructor's Guide are 17C-17F, and are carried out in the construction of a 4'x 4' building which is torn apart at the end of the course.	
1. Demonstrate the use of any tools or machines which will be needed if not previously demonstrated.	
2. Demonstrate how to "crown" a joist, and how to lay out the position of joists on the joist header.	2. Observe demonstration
3. Divide the class into groups of 3-5, and assign each group a task.	
4. Supervise students' work	4. Cut joist headers to exact length.
5. Supervise student's work	5. Cut joists to exact length
6. Supervise student's work	6. Mark the position of the joists on the joist header
7. Supervise student's work	7. Position joists and headers with "crown up", and nail in place.
8. Supervise student's work	8. Place floor frame on concrete blocks and level by shimming with thin pieces of wood.
9. Supervise student's work	9. Check squareness of floor frame by measuring diagonals

TEACHER	STUDENT
10. Demonstrate proper placement, nailing, marking, and trimming of subfloor.	10. Nail subfloor to floor frame.
11. Supervise student's work.	11. Mark edges and cut away excess sheathing.

PERFORMANCE OBJECTIVE (8 days)

TASK/COMPETENCY: (COS-031) Build a wood-frame wall system.

EQUIPMENT/SUPPLIES: Portable electric circular saw or radial arm saw, 12' tape, 2 framing squares, 10 claw hammers 4' level, chalkline, portable sabre saw or sawzall, 8' step-ladder.

STANDARD OF PERFORMANCE: Walls will be straight and plumb within 1/8".

ENABLING OBJECTIVE: Use of portable circular saw or radial arm saw; drive nails.

REFERENCES

TEACHER	STUDENT
1. Recommended Exploring Construction, Chapter 17, "Building Superstructures." 2. Suggested Principles and Practices of Residential Construction, Chapter 10, "Wall Framing."	1. Recommended Exploring Construction, Chapter 17, "Building Superstructures."

SELECTED INSTRUCTIONAL MATERIALS: Same as previously listed.

ACTIVITIES

TEACHER	STUDENT
1. Briefly review the names of the components of a wood-frame wall system. 2. Give specific instruction on how to locate and lay out door and window openings.	

TEACHER	STUDENT
3. Divide class into four groups, one for each wall.	
4. Supervise students' work	4. Cut top and bottom plates to length.
5. Supervise student's work	5. Cut studs to length
6. Supervise student's work	6. Lay out position of studs on plates
7. Supervise student's work	7. Cut material for headers for door and/or window.
8. Supervise students' work	8. Assemble and nail headers
9. Supervise students' work	9. Position wall components and nail in place
10. Supervise students' work	10. Place wall on floor frame and nail in place.
11. Demonstrate plumbing a wall with a 4' level.	11. Brace wall if needed. Check for plumb with 4' level.
12. Supervise students' work	12. Install second top plate
13. Demonstrate cutting and applying sheathing.	13. Observe demonstration
14. Supervise students' work	14. Cut sheathing to size and nail to exterior of wall.
15. Supervise students' work	15. Cut out door and window openings if not done before installing sheathing.

PERFORMANCE OBJECTIVE (12 days)

TASK/COMPETENCY: (COS-032) Build a wood-frame roof system.

EQUIPMENT/SUPPLIES: Portable electric circular saw or radial arm saw, 12' tape, 2 framing squares, 10 claw hammers, 4' level, chalkline, portable sabre saw.

STANDARD OF PERFORMANCE: Rafters will be spaced within 1/4" of exact location; will fit at wall and ridge with 3/16 gap or less; roof sheathing will be trimmed flush with edges, and nailed properly.

ENABLING OBJECTIVE: Use of portable circular or radial arm saw, use of portable sabre saw, use of level, use of chalkline.

REFERENCES

TEACHER	STUDENT
1. Recommended Exploring Construction, Chapter 17, "Building Superstructures." 2. Suggested Principles and Practices of Residential Construction, Chapters 11 and 12, "Ceiling and Roof Framing."	1. Recommended Exploring Construction, Chapter 17, "Building Superstructures."

SELECTED INSTRUCTIONAL MATERIALS: Same as previously listed

ACTIVITIES

TEACHER	STUDENT
1. Discuss the purpose of ceiling joists, and demonstrate how to lay out and cut the angle on each end. The one	1. Observe demonstration.

TEACHER	STUDENT
done as demonstration can become the pattern.	
2. Demonstrate how to lay out and cut a rafter. The one done can become the pattern. NOTE: Instead of ceiling joists and rafters, roof trusses may be constructed. If so, demonstrate layout and assembly of a truss.	2. Observe demonstration
3. Divide the class into groups of 3-5, and assign jobs to each group.	
4. Supervise students' work.	4. Cut ceiling joists to length, and cut angles on each end.
5. Supervise students' work.	5. Lay out position of rafters and ceiling joists on top plates.
6. Supervise students' work.	6. Nail ceiling joists in place.
7. Supervise students' work.	7. Mark and cut rafters. (Ridge cut and bird's mouth only--leave tails long.)
8. Supervise students' work.	8. Cut ridge board and lay out position of rafters on it, corresponding to positions already laid out on wall plates.
9. Explain to entire class the method of setting the first four rafters and ridge board. Note nailing techniques at ridge and plate.	9. Erect ridge board with two rafters at each end.
10. Supervise students' work.	10. Nail remaining rafters in place.

TEACHER	STUDENT
11. Discuss various ways fly rafters can be supported, and explain the techniques you will be using.	11. Trim ends of ridge board to exact length, nail fly rafters in place.
12. Demonstrate the marking of the vertical cut on the rafter tails.	12. Mark overhang on tails of rafters and trim.
13. Explain purpose of edge band and its installation.	13. Cut edge band to length, bevel edge, and nail to rafter tails.
14. Explain the purpose and describe the placement of nailing strips for soffit.	14. Cut nailing strips and nail in place
15. Explain the placement of 4 x 8 sheets of sheathing and demonstrate the placement and nailing of the first two or three sheets.	15. Place and attach roof sheathing.
16. Explain the purpose and placement of fascia, using short pieces to show how it fits at the corners, and at the edge of the sheathing. Note that fascia on eaves is usually grooved to receive soffit.	16. Cut and apply fascia.
17. Explain the purpose of roofing felt and the metal drip cap and demonstrate their attachment.	17. Apply roofing felt and metal drip cap.

PERFORMANCE OBJECTIVE (1 day)

TASK/COMPETENCY: (COS-033) State the purpose and function of roofing and name some common roofing materials.

EQUIPMENT/SUPPLIES: None

STANDARD OF PERFORMANCE: The purpose and function of roofing materials, and the names of common materials, will be described and listed with 75% accuracy according to the textbook.

REFERENCES

TEACHER	STUDENT
1. Recommended Exploring Construction, Chapter 18, "Enclosing the Structure." 2. Suggested Principles and Practices of Residential Construction, Chapter 13, "Roofing".	1. Recommended Exploring Construction, Chapter 18, "Enclosing the Structure."

SELECTED INSTRUCTIONAL MATERIALS: Samples of as many types of roofing materials as the instructor can obtain.

ACTIVITIES

TEACHER	STUDENT
NOTE: The activities in this duty area are designed to be done in the building of a storage building, playhouse, or other small building. The alternate activities from Exploring Construction are 18A-18I.	
1. Present an illustrated lecture on roofing, using the samples of roofing materials to illustrate the appearance of each type of roofing and as much as possible about the application.	

TEACHER	STUDENT
2. Give students several examples of familiar buildings in the community and have them list the building and the types of roofing it has.	2. List types of roofing used for buildings as instructed.
3. If time allows, begin demonstration on applying asphalt/ fiberglass shingles.	3. Observe demonstration.

EXTERIOR FINISHING AND ROOFING

PERFORMANCE OBJECTIVE (5 days)

TASK/COMPETENCY: (COS-034) Apply shingles on a wood-frame roof.

EQUIPMENT/SUPPLIES: 6 claw hammers, chalkline, 10 12" measuring tapes, 4 utility knives, 2 cutting boards for shingles (plywood about 20" x 40"), 10' stepladder or extension ladder.

STANDARD OF PERFORMANCE: Shingles will be in straight courses , slots will be aligned vertically within 1/2", gable ends will be straight within 1/4".

REFERENCES

TEACHER	STUDENT
1. Recommended Exploring Construction, Chapter 18, "Enclosing the Structure." 2. Suggested Principles and Practices of Residential Construction, Chapter 13, "Roofing."	1. Recommended Exploring Construction, Chapter 18, "Enclosing the Structure."

ACTIVITIES

TEACHER	STUDENT
1. Demonstrate the cutting and placement of asphalt shingles to obtain proper overlap and pattern. (Instructions are on the back of all bundles of shingles). This may be done on a work bench inside rather than on the roof to improve students' view of the process.	1. Observe demonstration.

TEACHER	STUDENT
2. Divide the class into four groups. Two groups of three can work on the roof, while the other groups serve as "ground crews", cutting shingles and carrying them up, etc. Groups should be switched about halfway through the roofing to give everyone experience with all operations.	2. Chalk lines on roof to guide shingle placement.
3. Supervise students' work.	3. Cut starter shingles roof edges.
4. Supervise students' work.	4. Nail starter shingles.
5. Supervise students' work.	5. Cut and nail in place remainder of shingles.
6. Supervise students' work.	6. Cut ridge caps from full shingles or full-tab scraps.
7. Supervise students' work.	7. Chalk line for one edge of ridge cap and nail ridge caps in place.

PERFORMANCE OBJECTIVE (5 days)

TASK/COMPETENCY: (COS-035) Install a plywood soffit and a cornice return.

EQUIPMENT/SUPPLIES: Portable circular saw or radial arm saw, table saw, 4 claw hammers, 6' ladder.

STANDARD OF PERFORMANCE: The soffit will be fitted within 1/4" of walls, and have tight butt joints at ends.

ENABLING OBJECTIVE: Use table saw to rip plywood.

REFERENCES

TEACHER	STUDENT
1. Recommended Exploring Construction, Chapter 18, "Enclosing the Structure." 2. Suggested Principles and Practices of Residential Construction, Chapter 16, "Exterior Wall Covering and Roof Trim."	1. Recommended Exploring Construction, Chapter 18, "Enclosing the Structure."

SELECTED INSTRUCTIONAL MATERIALS: A cross-section of the edge of a roof, showing the rafters, wall, roof sheathing, fascia, and soffit should be used. It may be sketched on the chalkboard or made into an overhead transparency.

ACTIVITIES

TEACHER	STUDENT
1. Explain the purpose of soffit and the means by which it must be fitted. Use sketch or overhead transparency.	

TEACHER	STUDENT
2. Cut one piece of soffit and nail it in place, calling attention to the proper placement and nailing techniques.	2. Observe demonstration.
3. Divide the class into groups of 3-5, and assign tasks.	3. Cut soffit pieces to correct length and width.
4. Supervise students' work.	4. Nail soffit in place.
5. Demonstrate the cutting and placement of the cornice return pieces.	5. Observe demonstration.
6. Supervise students' work.	6. Cut and nail cornice return pieces in place.
NOTE: The first two groups to finish their tasks will need to be assigned to install the door and window. Break at this point for a demonstration. (See Activity COS-036).	

PERFORMANCE OBJECTIVE (2 days)

TASK/COMPETENCY: (COS-036) Install a pre-hung door and a window in a wood-frame wall.

EQUIPMENT/SUPPLIES: 4 claw hammers, 4' level, cedar shims, #16 galvanized casing or finishing nails.

STANDARD OF PERFORMANCE: The units will be level and plumb. The door will open and close smoothly.

REFERENCES

TEACHER	STUDENT
1. Recommended Exploring Construction, Chapter 18, "Enclosing the Structure." 2. Suggested Principles and Practices of Residential Construction, Chapter 15, "Doors and Windows."	1. Recommended Exploring Construction, Chapter 18, "Enclosing the Structure."

SELECTED INSTRUCTIONAL MATERIALS: Same as previously listed.

ACTIVITIES

TEACHER	STUDENT
1. Discuss the various types of doors and windows available for use in buildings. 2. Bring door and window units near their respective rough openings and explain	

TEACHER	STUDENT
how they are to be placed and fastened. NOTE: Since it is not possible for the whole class to be occupied on this activity, assign one group each to the door and window, while the others finish the soffit and cornice return.	
3. Supervise students' work.	3. Place door or window in rough opening and check top and sides for level and plumb.
4. Supervise students' work.	4. Shim around the jambs to approximately center the unit in the opening, and to adjust for level and plumb.
5. Supervise students' work.	5. Nail units in place, but do not drive nails completely until re-checking for level and plumb.

PERFORMANCE OBJECTIVE (1 day)

TASK/COMPETENCY: (COS-037) State the purpose and function of exterior wall coverings, and name some of the materials commonly used.

EQUIPMENT/SUPPLIES: None

STANDARD OF PERFORMANCE: The purpose and function, as well as the names of common wall covering materials, will be stated with 75% accuracy according to information presented in class and in the textbook.

REFERENCES

TEACHER	STUDENT
1. Recommended Exploring Construction, Chapter 18, "Enclosing the Structure." 2. Suggested Principles and Practices of Residential Construction, Chapter 16, "Exterior Wall Covering and Roof Trim," Chapter 17, "Masonry." Principles and Practices of Heavy Construction, Chapter 16, "Finishing."	1. Recommended Exploring Construction, Chapter 18, "Enclosing the Structure."

SELECTED INSTRUCTIONAL MATERIALS: Filmstrip/cassette, "Framing and Enclosing Residential Exteriors," and "Enclosing Nonresidential Structures." World of Construction Series. (Alternate: "Enclosing and Finishing the Structure," Exploring the Construction Industry Series.)

ACTIVITIES

TEACHER	STUDENT
1. Discuss briefly the purpose	

TEACHER	STUDENT
and function of exterior wall covering materials, as well as other exterior finish items such as soffit, and moldings used around windows, doors, and roof.	
2. Show filmstrip/cassette of your choice as listed above.	2. View filmstrip.
3. Following the filmstrip, show the class several examples of exterior wall materials--siding of various types, brick, stone, etc. (A local building materials dealer may be willing to come and bring samples to show the class).	3. Observe, discuss, ask questions.

PERFORMANCE OBJECTIVE (10 days)

TASK/COMPETENCY: (COS-038) Apply siding on a wood-frame wall.

EQUIPMENT/SUPPLIES: 10 claw hammers, chalk line, 4' level, portable circular saw, table saw, 6' step ladder.

STANDARD OF PERFORMANCE: Siding will fit with no more than 3/16" gap around doors and windows. Nails will be driven flush with surface.

REFERENCES

TEACHER	STUDENT
1. Recommended Exploring Construction, Chapter 18, "Enclosing the Structure." 2. Suggested Principles and Practices of Residential Construction, Chapter 16, "Exterior Wall Covering and Roof Trim."	1. Recommended Exploring Construction, Chapter 18, "Enclosing the Structure."

SELECTED INSTRUCTIONAL MATERIALS: Same as previously listed.

ACTIVITIES

TEACHER	STUDENT
NOTE: The following is for applying horizontal lap siding with 3" wood corner strips instead of metal corners. If siding in 4' x 8' sheets is used, the procedure is somewhat different.	
1. Demonstrate the placement of the corner strips. Use 6d and 8d galvanized nails.	1. Observe demonstration.

TEACHER	STUDENT
2. Demonstrate the process of applying horizontal lap siding.	2. Observe demonstration.
3. Divide the class into four groups and assign each group a wall on which to work.	3. Rip corner strips from a redwood 1x6 so that a corner of uniform width is exhibited.
4. Supervise students' work.	4. Cut a 2" starter strip of siding and nail in place.
5. Supervise students' work.	5. Measure and mark position of each piece of siding at all corners.
6. Supervise students' work.	6. Cut, fit, and nail the succeeding pieces of siding, overlapping the previous piece about 1 1/4" each time.

PERFORMANCE OBJECTIVE (1 day)

TASK/COMPETENCY: (COS-039) Describe the purpose and function of paint and caulk, and name some common types of each.

EQUIPMENT/SUPPLIES: None

STANDARD OF PERFORMANCE: The purpose and function of paint and caulk will be described, and three types of each will be named with 75% accuracy on a unit test.

REFERENCES

TEACHER	STUDENT
1. Recommended Exploring Construction, Chapter 18, "Enclosing the Structure." 2. Suggested Materials for Construction, Chapter 16, "Paint and Related Materials."	1. Recommended Exploring Construction, Chapter 18, "Enclosing the Structure."

SELECTED INSTRUCTIONAL MATERIALS: "Exterior Finishes for Wood," set of slides with narration. University of Wisconsin-Extension.

ACTIVITIES

TEACHER	STUDENT
1. Introduce the topic by mentioning some of the many different surfaces which are normally protected by paint. (Example: automobiles, file cabinets, boats). Then ask students to name some places in buildings where paint is used.	1. Participate in the discussion.

TEACHER	STUDENT
2. Summarize the purpose and function of both paint and caulk in buildings.	
3. Show slides on exterior finishes.	3. View slides.
4. Give a brief summary of the common types of paint and caulk. Note the differences between oil-base and latex paint, and caulks and sealants.	

PERFORMANCE OBJECTIVE (3 days)

TASK/COMPETENCY: (COS-040) Apply caulk around a door or window and paint a building exterior.

EQUIPMENT/SUPPLIES: 2 caulking guns, several paint brushes, 8' ladder, cans for cleaning brushes, paint thinner (if oil-base paint is used).

STANDARD OF PERFORMANCE: The caulk will form a uniform bead, and the paint will cover the surface with no skips.

REFERENCES

TEACHER	STUDENT
2. Suggested World of Construction, Readings 48 and 49, "Finishing the Exterior--Residential and Non-residential." Materials for Construction, Chapter 16, "Paint and Related Materials."	2. Suggested World of Construction, Readings 48 and 49, "Finishing the Exterior--Residential and Non-residential."

SELECTED INSTRUCTIONAL MATERIALS: Same as previously listed.

ACTIVITIES

TEACHER	STUDENT
1. Demonstrate opening a tube of caulk, putting it in the gun, and forming a smooth bead.	1. Observe demonstration.
2. Explain and demonstrate the correct procedure for painting.	2. Observe demonstration.
3. Divide class into groups and assign tasks.	3. Apply caulk around door and window.

TEACHER	STUDENT
4. Supervise students' work.	4. Paint exterior of building, starting at the highest point and working downward.
5. Demonstrate proper technique for cleaning brushes.	5. Clean brushes thoroughly and store for next use.

MECHANICAL AND ELECTRICAL SYSTEMS

PERFORMANCE OBJECTIVE (1 day)

TASK/COMPETENCY: (COS-041) Name the common mechanical and electrical systems in a building, and describe their purpose and function.

EQUIPMENT/SUPPLIES: None

STANDARD OF PERFORMANCE: The common mechanical and electrical systems, and their purpose and function, will be described with 75% accuracy according to information presented in class.

REFERENCES

TEACHER	STUDENT
1. Recommended Exploring Construction, Chapter 22, "Roughing in Electrical Power Systems." 2. Suggested Principles and Practices of Residential Construction, Chapter 18, "Mechanical Systems."	1. Recommended Exploring Construction, Chapter 22, "Roughing in Electrical Power Systems."

SELECTED INSTRUCTIONAL MATERIALS: "Utility Systems," filmstrip/cassette, World of Construction series. (Alternate: "Introduction to Installing Utilities," Exploring the Construction Industry series.

ACTIVITIES

TEACHER	STUDENT
NOTE: This is an introductory lesson to the unit on mechanical and electrical systems. 1. Briefly introduce the topic by emphasizing the importance of mechanical and electrical systems.	

TEACHER	STUDENT
Note that most of the modern conveniences that we take for granted nowadays are entirely dependent on these systems. 2. Show filmstrip/cassette. 3. If time allows, give the class a preview of what is planned for the rest of this unit.	2. View filmstrip.

PERFORMANCE OBJECTIVE (2 days)

TASK/COMPETENCY: (COS-042) Name the principal components of electrical systems and their function, and plan the circuits for a small residence.

EQUIPMENT/SUPPLIES: None

STANDARD OF PERFORMANCE: The correct components will be specified, and the proper number of circuits indicated with 75% accuracy on the floor plan, according to the requirements of the National Electrical Code.

REFERENCES

TEACHER	STUDENT
1. Recommended Exploring Construction, Chapter 22, "Roughing in Electrical Power Systems." 2. Suggested Principles and Practices of Residential Construction, Chapter 18, "Mechanical Systems." National Electrical Code, Latest edition, or a text based on the code.	1. Recommended Exploring Construction, Chapter 22, "Roughing in Electrical Power Systems."

SELECTED INSTRUCTIONAL MATERIALS: A floor plan of a small residence with all electrical outlets and appliances identified. Examples of as many electrical components as possible (switches, outlets, boxes, etc.) Box of colored pencils.

ACTIVITIES

TEACHER	STUDENT
1. Explain the purpose of an electrical system in a building--to distribute electricity to various appliances, equipment, or fixtures, and to do it safely and without detracting from the appearance of the building.	
2. Discuss the purpose and function of the following components of electrical systems using the examples of each: Meter, ground wire and rod, breaker box, circuit breakers, cable(note types), conduit, junction boxes, outlets, switches, light fixtures, appliances (differientiate between plug-in and direct-wired).	2. Participate in the discussion as appropriate.
3. Hand out the floor plans and explain to the class that they are to plan the circuits for this house and draw each circuit in a different color.	
4. Discuss the requirements of the National Electrical Code and the means of determining the size of a circuit. Note that if you know the wattage of an appliance and the voltage it requires, the current it draws can be calculated as follows: $\text{Current (amps)} = \frac{\text{Power(watts)}}{\text{Force(volts)}}$ Thus, a 2000 watt appliance on a 110 volt circuit would draw 18.18 amps of current.	

TEACHER	STUDENT
5. List the appliances in a house which normally require separate circuits, and those which require 220 volt circuits. Also explain the code requirements regarding small appliance circuits and lighting and convenience outlets.	
6. Supervise students' work.	6. Draw circuits on the floor plan with colored pencils.

PERFORMANCE OBJECTIVE (2 days)

TASK/COMPETENCY: (COS-043) Install electrical wiring in walls and ceilings.

EQUIPMENT/SUPPLIES: (Per group) Pre-built corner section (see drawing), electric drill with 1" dia. bit, 14-2 or 12-2 romex cable, 1 box cable staples, 4 single switch and outlet boxes, 1 ceiling junction box, claw hammer, diagonal cutters.

STANDARD OF PERFORMANCE: The wire will be pulled reasonably tight, and stapled to wood framing at correct intervals. About 6" of cable will be left at each box for wiring switches, outlets, etc.

REFERENCES

TEACHER	STUDENT
1. Recommended Exploring Construction, Chapter 22, "Roughing in Electrical Power Systems."	1. Recommended Exploring Construction, Chapter 22, "Roughing in Electrical Power Systems."

SELECTED INSTRUCTIONAL MATERIALS: Same as previously listed. NOTE: If a storage building is built in the class, this activity may be performed in the building by wiring it for a light and some outlets.

ACTIVITIES

TEACHER	STUDENT
NOTE: Have paneling removed from walls and ceiling of the corner section. 1. Demonstrate and/or explain the process of planning where to run	1. Observe demonstration.

TEACHER	STUDENT
wires, drilling holes, pulling cable through the framing, and stapling wire in place.	
2. Divide class into groups of 3-5 and assign work stations.	
3. Supervise students' work	3. Drill holes for wire if necessary.
4. Supervise students' work	4. Pull cable through holes to each box.
5. Supervise students' work	5. Staple cable in place within 1' of each box and about 3-4' between

PERFORMANCE OBJECTIVE (3 days)

TASK/COMPETENCY: (COS-044) Install and connect switches and duplex receptacles.

EQUIPMENT/SUPPLIES: (per group) screwdriver, diagonal cutter, needle-nose pliers, red wire nuts, 1 switch, 2 duplex receptacles, 1 porcelain light fixture, cover plates for switch and receptacles, wire strippers, utility knife.

STANDARD OF PERFORMANCE: All connections will be properly made; there will be no short circuits.

ENABLING OBJECTIVE: Use of diagonal cutters, needle-nose pliers, wire strippers.

REFERENCES

TEACHER	STUDENT
1. Recommended Exploring Construction, Chapter 22, "Roughing in Electrical Power Systems."	1. Recommended Exploring Construction, Chapter 22, "Roughing in Electrical Power Systems."

SELECTED INSTRUCTIONAL MATERIALS: Same as previously listed.

ACTIVITIES

TEACHER	STUDENT
NOTE: Paneling should be in place on the walls and ceiling of the room section, to properly represent an actual field situation. Electricians make connections after the walls and ceilings are finished.	
1. Using a switch, receptacle, and light fixture, and some 14-2 or 12-2 cable, show the class how power comes through	1. Observe demonstration.

TEACHER	STUDENT
the cable from the breaker box to an outlet, then to a switch, then to a light, etc. This can be done on a bench top with short pieces of wire so that the flow of current in the circuit can be traced easily.	
2. Divide the class into groups assign work stations, and give instructions regarding their tasks.	2. Cut cables to correct length at boxes, remove sheath, and strip wires about 3/4".
3. Supervise students' work.	3. Connect wires to outlets, switch, and light fixture.
4. Check work when complete.	4. Have instructor check your circuit when it is complete.

PERFORMANCE OBJECTIVE (1 day)

TASK/COMPETENCY: (COS-045) Name the principal components of plumbing systems and identify the common pipe fittings.

EQUIPMENT/SUPPLIES: None

STANDARD OF PERFORMANCE: The principal components and pipe fittengs will be named or identified with 75% accuracy according to the information presented in the filmstrip and by the instructor.

REFERENCES

TEACHER	STUDENT
1. Recommended Exploring Construction, Chapter 21, "Installing A Plumbing System." 2. Suggested Basic Plumbing Illustrated, Chapters 1-8.	1. Recommended Exploring Construction, Chapter 21, "Installing A Plumbing System."

SELECTED INSTRUCTIONAL MATERIALS: Filmstrip/cassette "Utility Systems", World of Construction series, or "Introduction to Installing Utilities," Exploring the Construction Industry series. Examples of several pipe fittings of plastic and copper.

ACTIVITIES

TEACHER	STUDENT
1. If filmstrip/cassette has been shown previously, review the coverage of plumbing by lecture or by re-showing all or part of the filmstrip.	1. View filmstrip.

TEACHER	STUDENT
2. Using the examples of fittings, explain the purpose and function of each. 3. Have students complete pages 42 and 43 of the Student Manual for Exploring Construction.	3. Complete the assignment as instructed.

PERFORMANCE OBJECTIVE (3 days)

TASK/COMPETENCY: (COS-046) Install plastic pipe in a wall section

EQUIPMENT/SUPPLIES: (per group) 40" 1 1/2" plastic pipe, 2 1 1/2" ells, 1 1/2" tee, 1 1/2" test plug, hacksaw, utility knife, metal strap, 1" roofing nails, glue for plastic pipe, sandpaper (120 grit) or steel wool, 1/2" drill and 2" drill bit or smaller drill and sabre saw or sawzall.

STANDARD OF PERFORMANCE: Pipes will fit into holes in framing, proper amount of glue will be judged by amount of squeeze-out, pipes will be properly fastened in place with metal strap.

ENABLING OBJECTIVE: Use of hacksaw.

REFERENCES

TEACHER	STUDENT
1. Recommended Exploring Construction, Chapter 21, "Installing A Plumbing System," and Activity 21C, "Roughing in Plastic Drain, Waste, and Vent Pipes," Instructor's Guide. 2. Suggested Basic Plumbing Illustrated, Chapters 1-8.	1. Recommended Exploring Construction, Chapter 21, "Installing A Plumbing System."

SELECTED INSTRUCTIONAL MATERIALS: Same as previously listed, plus the corner section illustrated in the Instructor's Guide for Exploring Construction, pp. 71-72, or one of the instructor's own design.

ACTIVITIES

TEACHER	STUDENT
1. Demonstrate the procedure for cutting plastic pipe, preparing surfaces, and gluing.	1. Observe demonstration.
2. Divide the class into groups according to the number of corner sections available.	
3. Explain what is to be done using one of the corner sections. Demonstrate cutting one hole for the plastic pipe.	3. Observe demonstration.
4. Supervise students' work.	4. Measure and cut pipe to length.
5. Supervise students' work.	5. Test-fit pieces without glue.
6. Supervise students' work.	6. Prepare pipe and fittings for gluing.
7. Supervise students' work.	7. Apply glue and assemble pipe and fittings in place.

PERFORMANCE OBJECTIVE (4 days)

TASK/COMPETENCY: (COS-047) Install copper pipes in a wall section

EQUIPMENT/SUPPLIES: (per group) 40" of 1/2" copper pipe, 2 1/2" copper ells, 2 1/2" copper test caps, solder,

STANDARD OF PERFORMANCE: Pipes shall fit the holes cut in the framing, solder joints shall be clean and complete.

REFERENCES

TEACHER	STUDENT
1. Recommended Exploring Construction, Chapter 21, "Installing A Plumbing System," and Activity 21A, "Roughing in Copper Water Lines," Instructor's Guide, p. 44.	1. Recommended Exploring Construction, Chapter 21, "Installing A Plumbing System."

SELECTED INSTRUCTIONAL MATERIALS: Same as previously listed, plus corner sections as illustrated in Appendix A (page 44) of the Instructor's Guide to Exploring Construction.

ACTIVITIES

TEACHER	STUDENT
NOTE: It is suggested that copper pipes for hot and cold water and plastic drain pipes for a sink or lavatory be installed in the corner section instead of single pipes with drop-eared ells. The position of the holes for the pipes may be changed as necessary.	
1. Demonstrate installing the backing board, drilling	1. Observe demonstration.

TEACHER	STUDENT
holes, cutting copper pipe, soldering copper fittings, and fastening pipe to the structure.	
2. Divide the class into groups of 3-5 and assign work stations.	2. Cut backing board blocks and backing board to correct size.
3. Supervise students' work.	3. Locate and drill holes for pipe.
4. Supervise students' work.	4. Measure and cut pipe.
5. Supervise students' work.	5. Clean pipe and fittings and solder together.
6. Supervise students' work.	6. Place pipe in position and fasten in place with metal strap.

PERFORMANCE OBJECTIVE (1 day)

TASK/COMPETENCY: (COS-048) Name some common methods of connecting copper and plastic pipe and fittings.

EQUIPMENT/SUPPLIES: None

STANDARD OF PERFORMANCE: The common methods of connecting copper and plastic pipe will be named with 75% accuracy according to the information given by the instructor in the demonstrations.

REFERENCES

TEACHER	STUDENT
2. Suggested Basic Plumbing Illustrated, Chapter 15, "Water Pipe and Fittings."	

SELECTED INSTRUCTIONAL MATERIALS: Several examples of threaded, compression, and flare fittings. Use steel, copper, brass, and plastic fittings if possible. Pipe wrench, adjustable wrench, bench vise, pipe dope and/or thread tape, flaring tool or pre-flared copper tubing.

ACTIVITIES

TEACHER	STUDENT
1. Introduce the topic by emphasizing the need for a plumbing system to be leak-proof, and the fact that connections are the most common source of leaks.	

TEACHER	STUDENT
2. Explain the difference between pipe threads and normal threads. Explain the purpose of pipe dope and demonstrate its use. Demonstrate the use of pipe wrench to screw pipe into a fitting.	2. Observe demonstration.
3. Explain the principle of the compression fitting, both plastic and brass. Demonstrate the attachment of a fitting and show students how the compression ring (brass) is crimped by the chamfered surfaces of the nut and the fitting to form a seal.	3. Observe demonstration.
4. Explain the way the flare joint forms a tight seal. Demonstrate the forming of the flare or show class a pre-formed piece of tubing, and assemble a connection using the flared tubing.	4. Observe demonstration.

PERFORMANCE OBJECTIVE (3 days)

TASK/COMPETENCY: (COS-049) State the general principles and name some of the main types of HVAC systems.

EQUIPMENT/SUPPLIES: (per group) Wall or corner section, tape measure, claw hammer, framing square, scratch awl, electric drill with a 3/4" spade bit, compass saw or electric sabre saw, heat duct boot, 5"x24" galvanized ductwork, small gauge wire, 4d nails.

STANDARD OF PERFORMANCE: The general principles and main types of HVAC systems will be stated with 75% accuracy according to the Activity Sheet and information presented by the instructor.

REFERENCES

TEACHER	STUDENT
1. Recommended Exploring Construction, Chapter 20, "Energy and Climate Control," and Activities 20A and 20B, Instructor's Guide.	1. Recommended Exploring Construction, Chapter 20, "Energy and Climate Control."

SELECTED INSTRUCTIONAL MATERIALS: Same as previously listed, plus home improvement catalogs, drawings from previous activity, "Designing Structures."

ACTIVITIES

TEACHER	STUDENT
1. Give a brief presentation on "Controlling the Climate in a Structure." 2. Divide the class into engineering teams.	

TEACHER	STUDENT
3. Refer the engineering teams to: a. The drawing produced in the "designing structures" activity b. A home improvement catalog from Sears or another company in your area. c. The "Climate Control Planning Sheet" in the Activities Packet.	
4. Give instructions on exactly what is to be done.	4. Consider each kind of system available and select the primary devices.
5. Help as needed.	5. Determine how to distribute the conditioned air.
6. Help as needed.	6. Estimate the cost of the installation.
7. Help as needed.	7. Summarize the decisions on the Climate Control Planning Sheet.
8. Give a brief presentation on "Distribution Systems."	
9. Demonstrate cutting the hole, installing the boot, and attaching the ductwork.	9. Observe demonstration.
10. Divide the class into groups of 3-5.	10. Lay out and cut hole for boot.
11. Supervise work.	11. Install the boot, attach and anchor ductwork.
	12. Report to instructor when job is complete.

PERFORMANCE OBJECTIVE (2 days)

TASK/COMPETENCY: (COS-050) Name some common types of communications systems used in buildings and identify the major components of each.

EQUIPMENT/SUPPLIES: (Per group) Wood frame structure or corner section, claw hammer, electric drill, 3/8" bit, tape measure, screwdriver, needlenose pliers, safety glasses, doorbell assembly, doorbell wire-white, doorbell wire-black, insulated staples.

STANDARD OF PERFORMANCE: The common types of communications systems and the components of each will be identified with 75% accuracy minimum, according to the information presented in the textbook.

ENABLING OBJECTIVE: Use of screwdriver, electric drill.

REFERENCES

TEACHER	STUDENT
1. Recommended Exploring Construction, Chapter 23, "Installing Communications Systems," and Activity 23A, "Roughing in A Doorbell Circuit," Instructor's Guide.	1. Recommended Exploring Construction, Chapter 23, "Installing Communications Systems."

SELECTED INSTRUCTIONAL MATERIALS: Same as previously listed.

ACTIVITIES

TEACHER	STUDENT
NOTE: This activity may be done as a demonstration only if supplies are not available for class to use.	
1. Give a brief presentation on "Communication Systems in Structures." 2. Brief students on the	

TEACHER	STUDENT
doorbell circuits.	
3. Divide class into groups of 3-5.	
4. Supervise students' work.	4. Plan placement of each part of the doorbell system before beginning work.
5. Supervise students' work.	5. Drill holes for wires.
6. Supervise students' work.	6. Mount transformer, buttons, and bell, and connect wires.
7. Check students' work.	7. Have instructor check work when complete.

INSULATION AND INTERIOR FINISH

PERFORMANCE OBJECTIVE (2 days)

TASK/COMPETENCY: (COS-051) State the reasons for insulating, name the materials from which insulation is made and the forms in which insulation is available.

EQUIPMENT/SUPPLIES: None

STANDARD OF PERFORMANCE: The reasons for insulating and the forms of insulating materials will be stated with 75% accuracy minimum, according to information given by the instructor and the textbook.

REFERENCES

TEACHER	STUDENT
1. Recommended Exploring Construction, Chapter 24, "Insulating Structures." 2. Suggested Materials for Construction, Chapter 15, "Insulation and Acoustical Materials."	1. Recommended Exploring Construction, Chapter 24, "Insulating Structures."

SELECTED INSTRUCTIONAL MATERIALS: Several types of insulation materials, flood light or heat lamp, test structure illustrated in Teacher's Guide, Appendix A.

ACTIVITIES

TEACHER	STUDENT
1. Give brief presentation on "How Heat Flows." Note how insulation slows heat flow.	

TEACHER	STUDENT
NOTE: An alternate activity is to have small boxes made of insulation materials, into which identical size ice cubes are placed. Leave for a specified time (15-30 minutes), then compare the size of the cubes from the different boxes.	
2. Demonstrate the experiment (Activity 24A, Instructor's Guide).	2. Observe demonstration.
3. Supervise students' work.	3. Carry out experiment as instructed.
4. Check work.	4. Report results to instructor.

PERFORMANCE OBJECTIVE (1 day)

TASK/COMPETENCY: (COS-052) Place insulation and vapor barrier in a wall or ceiling.

EQUIPMENT/SUPPLIES: Batt or roll insulation, polyethylene film, staple gun, gloves, dust masks, utility knife.

STANDARD OF PERFORMANCE: Insulation will be cut to stay in openings by friction and completely fill the space. Vapor barrier will be stretched reasonably tight and stapled securely.

REFERENCES

TEACHER	STUDENT
1. Recommended Exploring Construction, Chapter 24, "Insulating Structures," and Activity 24B, "Installing Insulation and Vapor Barriers," Instructor's Guide.	1. Recommended Exploring Construction, Chapter 24, "Insulating Structures."

SELECTED INSTRUCTIONAL MATERIALS: Same as previously listed.
NOTE: This activity may be done as a demonstration only.

ACTIVITIES

TEACHER	STUDENT
1. Give a brief demonstration on the techniques of cutting and placing insulation and vapor barrier.	1. Observe demonstration.
2. Divide class into groups and assign tasks.	
3. Supervise student's work.	3. Cut insulation to size.

TEACHER	STUDENT
4. Supervise student's work.	4. Place insulation in ceiling and wall spaces.
5. Supervise student's work.	5. Stretch polyethylene and staple in place.
6. Check work.	6. Have instructor check work.

INSULATION AND INTERIOR FINISHING

PERFORMANCE OBJECTIVE (1 day)

TASK/COMPETENCY: (COS-053) List the most common types of wall and ceiling finishing materials.

EQUIPMENT/SUPPLIES: None

STANDARD OF PERFORMANCE: The common types of wall and ceiling finishing materials will be listed with 75% accuracy minimum, according to information from the filmstrip and class lecture.

REFERENCES

TEACHER	STUDENT
1. Recommended Exploring Construction, Chapter 25, "Enclosing the Interior," and Chapter 26, "Finishing the Project." 2. Suggested Materials for Construction, Chapter 12, "Interior Wall Materials."	1. Recommended Exploring Construction, Chapter 25, "Enclosing the Interior," and Chapter 26, "Finishing the Project 2. Suggested

SELECTED INSTRUCTIONAL MATERIALS: Filmstrip/cassettes "Completing Residential Interiors," and "Enclosing Nonresidential Structures," World of Construction series; or "Finishing the Interior and Completing the Site," Exploring the Construction Industry series.

ACTIVITIES

TEACHER	STUDENT
1. Introduce the topic briefly. 2. Show filmstrip/cassette.	2. View filmstrip.

TEACHER	STUDENT
3. Using the samples of wall, ceiling, and flooring materials, discuss their use and application.	3. Participate in discussion.

PERFORMANCE OBJECTIVE (2 days)

TASK/COMPETENCY: (COS-054) Apply gypsum board to walls and ceilings.

EQUIPMENT/SUPPLIES: 2-4 sheets of gypsum board, claw hammers, utility knives, chalkline, drywall saw or sabre saw, drywall nails or screws.

STANDARD OF PERFORMANCE: Pieces cut will fit within 1/4" at any edge, nails will be set below surface of board.

REFERENCES

TEACHER	STUDENT
1. Recommended Exploring Construction, Chapter 25, "Enclosing the Interior," and Activity 25A, "Enclosing Interior Walls with Gypsum Board," Instructor's Guide. 2. Suggested Drywall: Installation and Application.	1. Recommended Exploring Construction, Chapter 25, "Enclosing the Interior."

SELECTED INSTRUCTIONAL MATERIALS: Same as previously listed.

ACTIVITIES

TEACHER	STUDENT
NOTE: This activity may be done in a previously built storage building or on a wall or corner section. If a storage building is used, gypsum board may need to be removed when the activity is finished.	
1. Demonstrate laying out and cutting gypsum board. (A professional drywall	1. Observe demonstration.

TEACHER	STUDENT
hanger may be invited to class to give this demonstration).	
2. Demonstrate placing and nailing gypsum board.	2. Observe demonstration.
3. Divide class into groups and assign tasks.	3. Measure, lay out, and cut gypsum board.
4. Supervise students' work.	4. Nail board in place.

PERFORMANCE OBJECTIVE (3 days)

TASK/COMPETENCY: (COS-055) Tape and finish a drywall joint.

EQUIPMENT/SUPPLIES: Drywall tape, finishing compound, 6" and 10" drywall knives, mud pan or hawk, sanding block, 120-180 grit sandpaper.

STANDARD OF PERFORMANCE: Joint will be smooth, without bubbles or ditches.

REFERENCES

TEACHER	STUDENT
1. Recommended Exploring Construction, Chapter 25, "Enclosing the Structure." 2. Suggested Drywall: Installation and Application.	1. Recommended Exploring Construction, Chapter 25, "Enclosing the Structure."

SELECTED INSTRUCTIONAL MATERIALS: Same as previously listed, plus videotape, "Drywall Finishing Techniques."

ACTIVITIES

TEACHER	STUDENT
1. Show videotape if available. If not, proceed with demonstration.	1. View videotape.
2. Demonstrate taping flat and corner joints. (A professional drywall finisher may be invited for this demonstration).	2. Observe demonstration.

TEACHER	STUDENT
3. Divide class into groups and assign tasks.	3. Tape the joints assigned.
4. Check work.	4. Have instructor check work, then clean knives and other tools.
5. Demonstrate application of second coat of "mud" or finishing compound.	5. Observe demonstration.
6. Supervise students' work.	6. Apply second coat to joints assigned.
7. Demonstrate sanding of second coat and application of third coat.	7. Observe demonstration.
8. Supervise students' work.	8. Sand second coat and apply third coat.
10. Supervise students' work.	11. Sand third coat when dry.

PERFORMANCE OBJECTIVE (1 day)

TASK/COMPETENCY: (COS-056) Describe some common types of kitchen and bath cabinets, and the associated attachments.

EQUIPMENT/SUPPLIES: None

STANDARD OF PERFORMANCE: The common types of cabinets and their attachments will be described with 75% accuracy minimum, according to information provided by the filmstrip and the instructor.

REFERENCES

TEACHER	STUDENT
2. Suggested Brochures from local building materials dealer on kitchen and bath cabinets.	

SELECTED INSTRUCTIONAL MATERIALS: Brochures of kitchen and bath cabinets, samples of cabinet doors, hardware, counter tops, etc. If possible, a filmstrip such as "Installing Cabinets," by Vocational Media Associates.

ACTIVITIES

TEACHER	STUDENT
1. Introduce the topic by discussing the importance of cabinets.	
2. Show filmstrip.	2. View filmstrip.
3. Using samples for illustration, make a presentation on the types of cabinets,	

TEACHER	STUDENT
their construction, the kinds of hardware necessary, and other relevant information.	

PERFORMANCE OBJECTIVE (1 day)

TASK/COMPETENCY: (COS-057) Define millwork and molding and cite examples of each.

EQUIPMENT/SUPPLIES: None

STANDARD OF PERFORMANCE: 75% accuracy minimum, according to the textbook and information presented by the instructor.

REFERENCES

TEACHER	STUDENT
1. Recommended Exploring Construction, Chapter 26, "Finishing the Project." 2. Suggested Materials for Construction, Chapter 13, "Doors, Windows, and Trim."	1. Recommended Exploring Construction, Chapter 26, "Finishing the Project."

SELECTED INSTRUCTIONAL MATERIALS: Samples of various types of molding (base, casing, shoe mold, chair rail, crown mold, etc.), brochures of millwork items such as doors, windows, stairs, mantels, etc.

ACTIVITIES

TEACHER	STUDENT
1. Define molding and millwork and cite their importance in a building. 2. Using the samples and brochures, discuss the most common molding and millwork items--their purpose and general	2. Participate in discussion.

TEACHER	STUDENT
application. 3. If time allows, have students work on assignment "Finishing the Project," in the Student Manual, pp. 52-52.	3. Work on assignment in Student Manual.

PERFORMANCE OBJECTIVE (2 days)

TASK/COMPETENCY: (COS-058) Install one type of molding in a building

EQUIPMENT/SUPPLIES: Molding as selected by instructor, miter-box, coping saw, claw hammers, 6d finish nails.

STANDARD OF PERFORMANCE: Joints will be reasonably tight, showing openings not exceeding 1/32".

REFERENCES

TEACHER	STUDENT
1. Recommended Exploring Construction, Chapter 26, "Finishing the Project."	1. Recommended Exploring Construction, Chapter 26, "Finishing the Project."

SELECTED INSTRUCTIONAL MATERIALS: Storage building, corner section, or wall section will need to be used for this activity.

ACTIVITIES

TEACHER	STUDENT
1. Demonstrate the use of the miter box to cut miters on molding.	1. Observe demonstration
2. Demonstrate the use of coping saw to cut coped joint.	2. Observe demonstration
3. Demonstrate the procedure for fitting and attaching moldings.	3. Observe demonstration

TEACHER	STUDENT
4. Divide class into groups and assign tasks(all groups may not be able to use the same molding).	4. Measure, mark, and cut molding.
5. Supervise work.	5. Nail molding in place.

PERFORMANCE OBJECTIVE (1 day)

TASK/COMPETENCY: (COS-059) Name several types of finish flooring and the general characteristics of each.

EQUIPMENT/SUPPLIES: Tape measure, chalkline, utility knife, framing square, notched adhesive trowel, adhesive, adhesive solvent.

STANDARD OF PERFORMANCE: 75% accuracy minimum, according to the textbook and information presented by the instructor.

REFERENCES

TEACHER	STUDENT
1. Recommended Exploring Construction, Chapter 26, "Finishing the Project," and Activity 26E, "Installing the Finish Floor," Instructor's Guide. 2. Suggested Materials for Construction, Chapter 14, "Flooring."	1. Recommended Exploring Construction, Chapter 26, "Finishing the Project."

SELECTED INSTRUCTIONAL MATERIALS: Samples of as many types of flooring as possible--hardwood plank, strip, and block, vinyl sheet, vinyl-asbestos tile, carpet, ceramic tile, terrazzo, slate, etc.

ACTIVITIES

TEACHER	STUDENT
1. Give a brief introduction to the purpose of flooring. 2. Using the samples for illustration, discuss the	2. Participate in discussion.

TEACHER	STUDENT
characteristics of each type of flooring, as well as the general methods of installation.	
3. Demonstrate laying out floor, spreading adhesive, and placing vinyl-asbestos tile. NOTE: Sheet vinyl may be used instead of tile.	3. Observe demonstration.
4. Divide class into groups and assign work stations.	4. Lay out position of tiles, spread adhesive and place tiles.

PERFORMANCE OBJECTIVE (20-40 days)

TASK/COMPETENCY: (COS-060) Design and build a project related to construction.

EQUIPMENT/SUPPLIES: Measuring tapes or bench rules, try squares, T-bevels, compass, handsaws, bandsaw or jig saw, table saw, drill press, radial arm saw, hammers, screwdrivers, general-purpose glue, wire brads (1/2" to 1"), grid paper for sketching, 10-20 bd. ft. of soft wood, cardboard, stiff celluloid plastic (clear), polyethylene film, other supplies depending on projects selected.

STANDARD OF PERFORMANCE: The project will be sketched and approved by the instructor, and built according to the plans.

ENABLING OBJECTIVE: Use of common measuring tools, saws, and common hand tools.

REFERENCES

TEACHER	STUDENT
2. Suggested	2. Suggested Messing Around With Drinking Straw Construction, by Zubrowski. How Bridges are Made, by Kingston. Solar Energy Systems Design, by Harris, et.al. Architecture: Design, Engineering, Drawing. Bennett & McKnight Division, Glencoe Publishing.

SELECTED INSTRUCTIONAL MATERIALS: As previously listed, plus any other "idea"-type books, articles, or materials which the instructor may obtain.

ACTIVITIES

TEACHER	STUDENT

The purpose of this activity is to give students an opportunity to apply some of the knowledge and skills learned in the course to this point, as well as to explore some aspect of construction of particular interest to them.

While the choice of a project should be as open as possible, the instructor will probably need to give students some guidance in making their selection. Having a number of books, articles, and other materials available should be helpful; the school librarian may be able to help with this part of the project, so that students could do some of their initial research in the library. Also, it is sometimes possible to obtain materials through the library which cannot be purchased with the technology education budget.

One of the great benefits of this project should be to explore types of construction which are new, unusual, or for some other reason more interesting than normal building construction. Some possibilities are listed below.

1. Build a solar collector.
2. Design and build a model bridge.
3. Design and build a model dam.
4. Build a model wind generator.
5. Build a model underground house.
6. Design and build a model superhighway interchange.
7. Build a model city.
8. Design and construct an air-supported structure. (See Exploring the Construction Industry).
9. Build a tramway.
10. Plan and build a model lunar habitat.

APPENDIX

Appendix A

CONSTRUCTION SYSTEMS

Equipment and Tools

Machines

10" Table saw
10" or larger radial arm saw
14" or larger band saw
Drill press (optional)
12" or larger planer (optional)
8" or larger jointer (optional)
Miter box (hand or power)

Portable Power Tools

7 1/4" circular saw (at least two)
Sabre saw
1/2" drill with right angle attachment and set of plumbers bits.
3/8" drill (optional)
Sawzall (optional)
Power plane (optional)

Hand Tools--Carpentry

Claw hammers (10)
12' measuring tapes (10)
50' measuring tape
Framing squares (4)
Try square (4)
Combination squares (2)
Sliding T-bevel (4)
4 or 6-pound sledge
Chalklines (2)
Hand saws (crosscut) (2)
Coping saws (4)
Wood chisel, 1" and 1 1/4" wide (4)
Jack plane or smooth plane (2)
Nail sets (4)
Set of twist drills, 1/16" to 1/2"
Nail aprons (10)
6' and 10' stepladders

Hand Tools--Masonry

Mixing hoe (2)
Shovel (2)
Magnesium float (2)
Finishing trowel
Edger

Brick or block trowel (4)
Joint finisher
4' mason's level

Hand Tools--Plumbing

Hacksaw
12" pipe wrench *
10" adjustable wrench
Set of open-end wrenches
Propane torches (2) *
Tubing cutter *
Set of flat screwdrivers
Set of phillips screwdrivers
Slip-joint pliers (2)
Channel-lock pliers *

Hand Tools--Electrical

Long-nose pliers (4) *
Diagonal cutters (4) *
Wire strippers (4) *
Conduit bender (optional) *

Hand Tools--Drywall

Drywall hammer (optional) *
4" or 6" taping knife (4-6) *
10" joint knife or trowel (4-6) *
Corner trowel (4) *
Sanding block *
Ceiling sander *
Mud pan or hawk (4-6) *
Utility knives (6)

Tools and Equipment--Surveying

Transit (optional) *
Tripod (optional) *
Surveyor's chain (optional) *
Range pole (optional) *
Level rod (optional) *

Tools and Equipment--Miscellaneous

Caulking guns (2)
Staple guns (2)
Leather gloves (6-10)
Notched adhesive trowel (4)

*Items not needed for 90-day offering

Appendix B
CONSTRUCTION SYSTEMS
Supply List

NOTE: If a storage building or other saleable structure is made in the class, the buyer normally pays for materials. Therefore, the following list does not include those materials.

1/4" grid paper, 8 1/2" x 11" or 11" x 17" *
Model building supplies--balsa, cardboard, paint, glue, etc.
1 roll (100') of light string
4' of band iron, 1/8" x 3/8"
1 roll of 4 mil polyethylene, 10'-14' wide
No. 3 rebar, 8 ft.
Tie wires for rebar (20)
4 8" x 8"x 8" concrete blocks (corner)
12 8"x8"x16" concrete blocks (corner)
11 8'x8"x16" stretcher blocks
2 foundation anchor bolts
2 bags pre-mixed mortar
1 bundle cedar shims
2" and 3" paint brushes
100' 14-2 or 12-2 romex cable *
Cable staples, 1 box of 100 *
20 switch and outlet boxes *
5 ceiling junction boxes *
Red wire nuts, 1 box of 100 *
5 single-pole switches *
10 duplex receptacles *
5 porcelain or plastic light fixtures *
5 single switch plates *
10 outlet plates *
20' of 1 1/2" plastic pipe (ABS or PVC) *
10 1 1/2" plastic ells *
5 1 1/2" plastic tees *
5 1 1/2" plastic test plug *
1 roll metal strap (for securing pipes to framing) *
4 small cans ABS or PVC cement *
120 grit sandpaper, 1 pkg. of 100 *
0 grade steel wool, 1 pkg. of 12 pads *
20' of 1/2" copper pipe *
10 1/2" copper ells *
10 1/2" copper test caps *
2 lbs. solder *
4 doorbell assemblies *
50' doorbell wire (black and red) *
1 roll or bundle of 3 1/2" fiberglass insulation *
1 roll or bundle of 5 1/2" fiberglass insulation *
1 box of 1000 3/8" staples *
Dust masks, box of 50 *
2-4 sheets 1/2" gypsum board
1 roll drywall tape, 250' *

1 bucket of joint compound *

Appendix C

CONSTRUCTION SYSTEMS

RESOURCES

I. Textbook

Exploring Construction. Richard M. Henak. South Holland, Illinois: Goodheart-Wilcox Company, Inc., 1985. NOTE: It is strongly recommended that a set of filmstrip/cassettes be purchased to accompany this text. The World of Construction series or Exploring the Construction Industry series is suggested in this guide, but others would serve as well.

II. Suggested References

World of Construction. Lux, Ray, Blankenbaker, and Umstattd. Encino, California: The Glencoe Publishing Company, 1982 (Bennett/McKnight Division). NOTE: This book is part of a system which includes a teacher's guide, a student laboratory manual, and a set of filmstrip/cassettes.

*Exploring the Construction Industry. Betts, Fannin, Hauenstein, Eds. Encino, California: The Glencoe Publishing Company, 1976. (Bennett/McKnight Division). NOTE: This book is part of a system which includes a teacher's guide, a set of filmstrip/ cassettes, and several teaching aids.

Underground. David Macaulay. San Diego, California, Creative Learning Systems, Inc. 1976. $15.99. An excellent reference to help visualize various types of foundations, as well as tunnels, subways, utility lines, and much more.

How Bridges are Made. Jeremy Kingston. San Diego, California, Creative Learning Systems, Inc. 1985. $10.99.

Guide to Professional Architectural and Industrial Scale Model Building. Pattison. Englewood Cliffs, NJ: Prentice-Hall, 1982.

*Principles and Practices of Residential Construction. Joseph Falcone. Englewood Cliffs, NJ: Prentice-Hall, 1987.

*Principles and Practices of Heavy Construction. Smith and Andres. Englewood Cliffs, NJ:

Prentice-Hall, 1986.

Drywall: Installation and Applications. W.R. Harris. Alsip, IL: American Technical Publishers.

Masonry Simplified. Dalzall and Townsend. Alsip, IL: American Technical Publishers.

Exterior and Interior Trim. John E. Ball. Albany, NY: Delmar Publishers, Inc.

*Introduction to Construction. Mark W. Huth. Albany, NY: Delmar Publishers, Inc., 1987.

Construction: Materials, Methods, Careers. Jack M. Landers. South Holland, IL: The Goodheart-Wilcox Company, Inc.

Materials for Construction. Spencer, Powell, and Hudson. Reston, Va.: Reston Publishing Co. (Prentice-Hall), 1980.

Basic Plumbing Illustrated. Howard C. Massey. Solana Beach, Calif.: Craftsman Book Company, 1980.

Solar Energy Systems Design. Norman C. Harris, Irving E. Thomas, and Cydney E. Miller. New York: John Wiley & Sons, 1985.

How Bridges Are Made. Jeremy Kingston and Arthur Lockwood. Creative Learning Systems, San Diego, Calif.

Messing Around With Drinking Straws. Bernie Zubrowski and Stephanie Fleischer. Creative Learning Systems, San Deigo, Calif.

III. Audiovisual Materials

Aries Films
4125 N.W. 14th Pl.
Gainesville, FL 32605

"Building Construction, Series I: Wood Frame," 46 min. 16mm film or videocassette, 1977. $495/$300

"Building Construction, Series II: Reinforced Concrete," 30 min. 16mm film or videocassette, 1980. $450/$250

"Building Construction, Series III: Structural Steel," 27 min. 16mm film or video cassette, 1981. $450/$250

*These references are suggested most frequently in the course

of study.

Bergwall Video Productions, Inc.
P.O. Box 238
Garden City, NY 11530

"Colonial Baseboard," 2 videocassettes. $161.00

"Electrical House Wiring Explained," 6 filmstrip/cassettes and study guide. $299.00

"Residential Electrical Wiring: Planning and Roughing In," 5 filmstrip/cassettes. $274.00

"Residential Electrical Wiring: Finishing the Installation," 5 filmstrip/cassettes. $274.00

"Residential Electrical Wiring: Low Voltage and Special Circuits," 6 filmstrip/cassettes. $329.00

"Passive Solar House Design," filmstrip/cassette/ $59.00

"Basic House Framing," (uses a scale model), 4 filmstrip/cassettes. $229.00

"Basic Plumbing and Pipe Fitting," 4 filmstrip/cassettes. $199.00

Vocational Media Associates
P.O. Box 1050
Mount Kisco, NY 10549-9989

"Safety in Residential Construction." Filmstrip or video. $109.00

"Safety in Electrical Work." Filmstrip/cassette. $109.00

"Careers in Construction." Filmstrip/cassette. $ 97.00

"Construction Estimating." Filmstrip or video (4 parts). $219.00

"Foundations." Five-part video series. $269.00

"Roofing." Five-part video series.

$269.00

"Floor and Wall Framing." Six-part video series. $297.00

"Completing the Exterior." Three-part video series. $169.00

"Rough Plumbing and Heating." Three-part video series. $169.00

"Completing the Interior." Five-part video series. $269.00

"Paints and Painting." Three-part video series. $169.00

"Stains." Two-part sound filmstrips. $109.00

"Basic Masonry Skills." Ten-part video series. $497.00

"Housebuilding: Structural Styles." Four-part sound filmstrips. $219.00

"Electrical House Wiring." Five-part video series. $279.00

"Residential and Commercial Solar Systems." Three sound filmstrips. $169.00

"Installing Cabinets." Sound filmstrip. $ 59.00

"Surveying." Five-part video series. $742.00

"Residential Architecture." Five filmstrip/cassettes. $250.00

"Light Commercial Architecture." Six filmstrip/cassettes. $300.00

DCA Educational Products
424 Valley Rd.
Warrington, PA 18976

"Framing a Simple Building."

Set of 4 filmstrips. $295.00

"Building Construction."
Set of 24 transparencies. $132.75

"Electrical Wiring--Residential."
Set of 14 transparencies. $119.50

"The Masonry Trade."
Set of 44 transparencies. $152.00

"Masonry Construction."
Set of 30 transparencies. $112.00

"Building Construction--Exterior."
Set of 3 filmstrips. $220.00

"Building Construction--Interior."
Set of 3 filmstrips. $220.00

"Electrical Wiring."
Set of 4 filmstrips. $295.00

"Wiring a House."
Set of 4 filmstrips. $295.00

"Basic Plumbing Skills."
Set of 3 filmstrips. $220.00

"Residential Plumbing."
Set of 4 filmstrips. $295.00

"Masonry."
Set of 4 filmstrips. $295.00

"Masonry. Second Series."
Set of 4 filmstrips. $295.00

Teaching Aids, Inc.
P.O. Box 1798
Costa Mesa, CA 92626-0798

"Careers in Building Trades."
Set of 6 filmstrip/cassettes. $ 89.95

International Film Bureau

332 S. Michigan Ave.
Chicago, IL 60604

"Electric Circular Handsaws."
18 1/2 min. videocassette $475.00
3-day rental $ 50.00

RMI Media Productions, Inc.
2807 W. 47th St.
Shawnee Mission, KN 66205

"Drywall Finishing Techniques."
31 min. videotape. $113.00

Circle Oak Productions
Girdle Ridge Dr.
Katonah, NY 10536

"The Foundation." 16mm color film.
"The Wood Shell." 16mm color film.

University of Wisconsin-Extension
Bureau of Audio Visual Instruction
P.O. Box 2093
Madison, Wisconsin 53701

"Exterior Finishes for Wood," set of 65 slides with narration.

John Wiley & Sons, Inc. Publishers
Eastern Distribution Center
1 Wiley Drive
Somerset, New Jersey 08873

Set of 355 slides with teaching script on Building Control Systems. $350.00

Glencoe Publishing Company
Bennett & McKnight Division
809 W. Detweiller Dr., Dept. IE/FL 86
Peoria, IL 61615

Set of filmstrip/cassettes on heavy construction $35.43 each.

"Site Investigation"
"Site Layout and Site Work"
"Horizontal Construction"

"construction Equipment I"
"Construction Equipment II"
"Foundations and Formwork I"
"Foundations and Formwork II"
"Pile Foundations I"
"Pile Foundations II"
"Formwork for Concrete: Beams and Slabs"
"Formwork for Concrete: Slabs"
"Flying Forms and Form Coatings"
"Tilt-up Construction"
"Structural Glue-Laminated Timber Construction"
"Masonry Construction"
"Glass Curtain Walls"
"Built-Up Roofing"
"Safety I"
"Safety II"

III. Computer Software

"Builder Comp." Cost-estimating package for small-to-medium-sized building contractors. List price $895.00. Requires Apple II Plus, IIe, IIc, IIG3.

Concept Communications
261 Shore Court
Burr Ridge, IL 60521

"Design Your Own Home: Architectural Design." Draw floor plans and elevations. $49.95. Requires Apple II, IIe, IIc, 48k.

"Design Your Own Home: Interior Design." $49.95. (Same as above)

Career Aids, Inc.
20417 Nordhoff St., Dept. IN
Chatsworth, CA 91311

Test Questions for Building Trades--Apple II, IIe, IIc, 48k.
Concrete and Related Review, $29.50.
Carpentry and Related Review, $29.50.
Building Construction and Related Review, $29.50.
Mixing and Casting Concrete, $39.50.
Types and Costs of Wood Building Materials, $39.50.
Rafter Terminology and Tables, $39.50.

National Innovative Media Co.
Route #2, Box 301B
Calhoun, KY 42327

"Words of Foundation Framing." Vocabulary, 3 disks, Apple, $125.00.
"Words of House Framing." Vocabulary, 8 disks, Apple, $336.00.
"Words of Roof Framing," Vocabulary, 3 disks, Apple, $125.00.
"Words of Trimwork." Vocabulary, 5 disks, Apple, $210.00.
"Words of Cabinetmaking." Vocabulary, 4 disks, Apple, $168.00.

V. Kits for Models

"Superstructures," Fischertecknik Experiment and Models. Superstructures Kit--$77.99
Start 100 Set--$59.99
Storage Case with baseplate top--$53.99

Creative Learning Systems, Inc.
9889 Hibert, Suite E
San Diego, Calif. 92131

"Domekit 1," Includes handbook explaining how to construct domes. Build domes up to about 10" in diameter. $10.99 Creative Learning Systems (see address above)

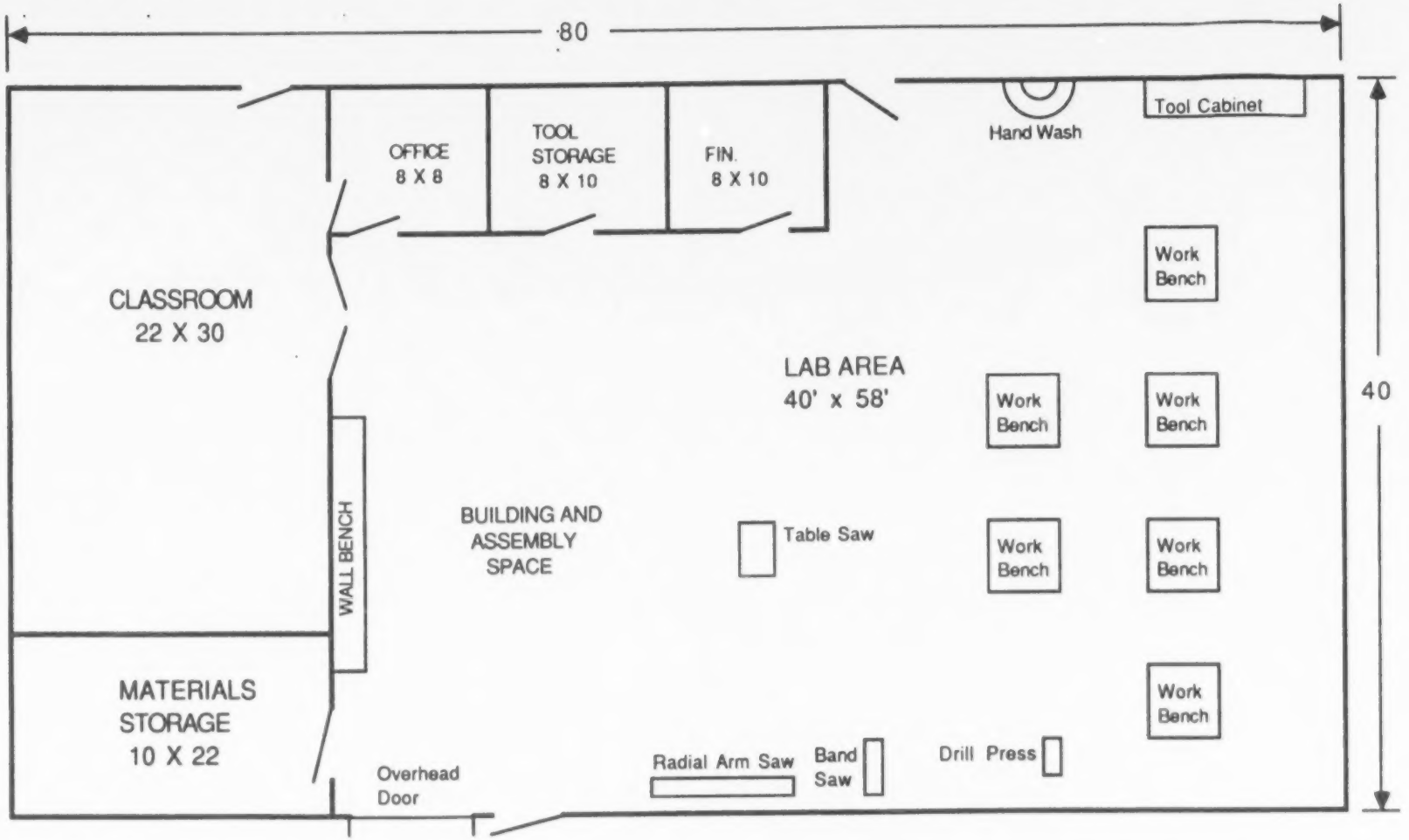
"House Framing Construction Kit," 3/4" scale model kit for teaching wood framing. Balsa wood, plans, base, nails, cutting tool, measuring tape, jig for angle cuts. Basic 2-Bedroom Home Kit--$65.00
A-Frame Home Kit--$65.00
Room Addition--$48.00

Career Aids, Inc.
20417 Nordhoff St. Dept. IN
Chatsworth, CA 91311

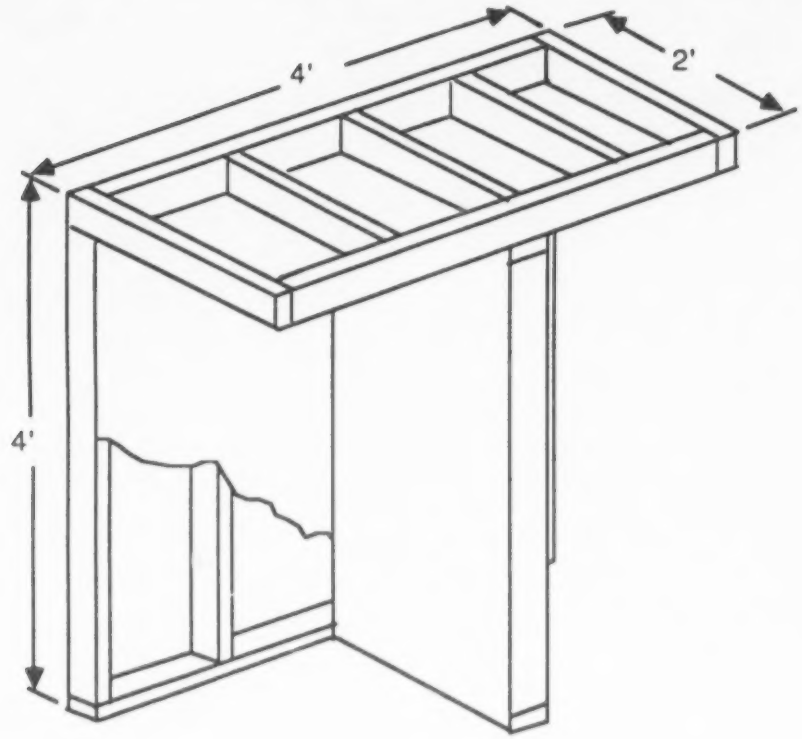
Bridge kits, wood, and other model supplies.

Midwest Products Co. Inc.
400 S. Indiana St.
P. O. Box 564
Hobart IN 46342
Bridge and architectural model supplies.

Pitsco
P. O. Box 1328
Pittsburg, KS 66762



Suggested Facilities Layout
for
CONSTRUCTION SYSTEMS COURSE
FOR EXAMPLE ONLY
(For detail specifications contact Industrial Education Unit)



CORNER SECTION

Framed of 2 x 4's, this corner section may be used for a number of different activities in construction. It is designed to be placed on a workbench, back-to-back with another one like it. This creates four work stations at each bench if needed. Each of the three pieces (2 walls and 1 ceiling panel), should be built separately and then assembled with screws to form the corner section so that it may be dismantled and stored easily. Note that when the unit is placed on a workbench, the height of the ceiling is more representative of typical ceiling height, which is useful in lending realism to experiences such as insulating, wiring, and paneling or drywall work. A floor panel may be added if desired.

APPENDIX F

Definition of Terms

Aggregate: The gravel or broken stone used in concrete.

Anchor Bolt: A round rod, threaded on one end, with a nut, used to secure the sill plate to the foundation.

Arch: An arrangement of a structure which carries the weight over an opening.

Asbestos: An incombustible fibrous mineral substance used for siding materials and fireproofing.

Attic: The space directly beneath the roof of a house.

Awning Window: An out-swinging window hinged at the top.

Backfill: The earth used to fill in around foundation walls after they are completed.

Balloon Frame: A type of building framework in which the studs extend from the foundation to the eaves without interruption by horizontal members.

Baseboard: The finishing board that covers the wall where it joins the floor.

Basement: The lowest story of a building. It may be above ground, partially above the ground, or entirely below ground level.

Base Shoe: A molding strip used next to the floor for interior baseboards.

Batten: A narrow-strip of wood used as a cleat across parallel boards or to cover joints between boards.

Batten Boards: Boards set up at the corners of a new construction from which are stretched lines marking off the wall.

Beam: A horizontal building member which supports a load.

Bearing Partition: A partition supporting a vertical load.

Bench Mark: A point of reference used by surveyors when establishing lines and grades.

Beveled Siding: Siding boards cut at a slant along each edge.

Bridging: The cross bracing between joists or studs to align and stiffen them.

Btu: A unit used to measure heat, British thermal unit.

Building Line: The line on a plot, established by law beyond which the building must not extend.

Cantilever: An overhanging part of a structure supported at one end only.

Casement: The glass frame of a window which turns on hinges fastened to one edge of the frame.

Casing: The interior trim around a door or window.

Caulking Compound: A nonhardening paste used to fill cracks and crevices.

Cellar: A story of a building entirely under ground.

Center to Center: Refers to measurements taken from the center of one member to the center of another member, abbreviated c to c, or oc.

Ceramic Tile: Tile made of clay, used for walls and floors.

Circuit: The path over which an electric current may pass.

Circuit Breaker: A device for opening and closing an electric circuit.

Collar Beam: A horizontal beam tying together two opposite rafters of a roof, usually at a level considerably above the wall plate.

Column: A vertical supporting member.

Concrete: Sand, portland cement, and gravel or broken stone mixed with water and allowed to set or harden.

Conductor: Any material which will transmit an electric current.

Conduit: Tubing, usually metal, used to protect electric wires.

Contractor: Someone offering to perform specified work for an agreed sum of money.

Corner Bead: A metal strip fastened to exterior corners before plaster is applied, serving to protect the corners from chipping.

Cornice: That part of the roof which extends horizontally beyond the wall.

Cove Molding: A concave molding used on inside corners.

Crawl Space: The space between the floor joists and the ground, when a cellar or basement is omitted.

Curtain Wall: An enclosing wall which provides no structural support to the house.

Double-Hung Window: A window made up of an upper and lower sash which slide past each other vertically.

Drain: A pipe or other contrivance which carries away waste water.

Drip Cap: A wood or aluminum member installed over windows and doors and designed to deflect water from the face of a building.

Drywall: A wallboard made of gypsum contained between two layers of paper.

Ducts: Sheet metal tubes to distribute cool or warm air.

Eave: The projecting lower portion of a roof beyond the wall line.

Elbow: A section of a pipe or fitting in the shape of an L.

Elevation: The height of a point above sea level or some other datum point.

Enamel: Paint with a considerable amount of varnish in it that produces a hard, glossy surface on wood or other materials.

Excavation: A hole in the ground, usually for the purpose of placing a building foundation.

Face Brick: Brick used for the outside face of the wall exposed to view.

Fascia (or Facia): A vertical board used at the end of rafters.

Firebrick: A special hard-burned brick made of fireclay to resist heat.

Fixture: An electrical or plumbing item which is attached in a definite location.

Flashing: Sheets of metal which are installed to seal building joints tight against the weather.

Floor Plan: The drawing or orthographic view of a horizontal floor of a structure showing partitions, doors, windows, etc.

Flue: An interior opening in a chimney.

Flush Door: A door in which both surfaces are flat planes.

Folding Door: A door made of fabric, wood sections, or plastic in such a manner that it will fold to one side of the opening.

Footing: The lower part of the foundation which rests on the ground.

Foundation: The supporting wall or part of the structure which rests on the footing.

Framing: The bare wood or metal skeleton of a structure.

Furring: Wood strips fastened to a wall for the purpose of attaching covering material.

Fuse: A strip of soft metal inserted in an electric circuit and designed to melt and open the circuit if the current exceeds a predetermined value.

Gable: A triangular portion of the end wall formed by a sloping roof.

Gable Roof: A roof that slopes up from only two walls of a building.

Girder: A wood or steel horizontal member designed to carry a load between two supports.

Grade: The level of the ground around the building.

Gutter: A trough designed to carry off water.

Hangers: Metal straps used to support pipes, gutters, etc.

Header: A horizontal cross member used to frame over openings.

Hearth: The masonry part of a floor in front of a fireplace.

Hip Rafter: The rafter at the junction of two sloping roofs that form an exterior angle.

Hip Roof: A roof that slopes up from four walls of a building.

Hollow Core Door: A flush door consisting of two outer plywood surfaces over a core of glued strips which form a honeycomb.

Horizontal: Parallel to or measured in a plane of the horizon, that is, where the earth appears to meet the sky.

House Drain: The piping inside a building that carries off the discharge from all waste and soil piping.

I Beam: A steel beam shaped in the form of an I.

Initial Set: The first setting action of mortar or concrete.

Insulation: A special material placed in walls, floors, or ceilings to reduce transfer of heat between two surfaces. Also, used to cover pipes and ducts.

Jack Rafter: A short rafter placed between the hip rafter or valley rafter and the roof ridge.

Jamb: The vertical sides of a door or window frame.

Joist: The wood framing members which support the floor.

Kerf: A cut or notch made by a saw.

Lally Column: A vertical supporting member made from steel pipe and usually filled with concrete.

Laminated: Consisting of several layers of material glued or cemented together.

Lath: Wood strips or sheets of metal with holes, nailed to studs and joists to hold plaster.

Lineal: A term applied to measurements along a single line.

Lintel: A horizontal member placed above a masonry opening to support the load above.

Load Bearing: A term applied to a wall supporting part of the weight of the building.

Lookout: A short wooden extension which supports the overhanging portion of a roof or gable end.

Lot Lines: The boundary lines of a parcel of land.

Manhole: An opening in a pipe, sewer, or other structure to allow access for a man.

Mantel: A shelf over a fireplace.

Masonry: Brick, stone, or similar material is installed by a mason.

Millwork: Woodwork furnished and milled in woodworking shop.

Miter: A beveled surface cut on the ends of molding or framing to make them fit together as in a picture frame.

Module: A standardized unit of measurement in which materials are manufactured.

Monument: A stone marker placed to serve as a point of reference for surveyors.

Mortar: A mixture of sand, cement, and water, and sometimes also lime, used for bonding.

Nominal Size: A size existing in name only and not necessarily agreeing with the actual size, i.e., the size before dressing.

Nonferrous: A metal which does not contain iron.

Nosing: The rounded projecting edge of a stair tread, not included in the tread measurement.

Open Web Bar Joist: A joist made up of light metal members and bars.

Outlet: Electricity--The socket to which connection can be made for a lamp or extension plug. Piping-the end or side of a pipe, valve, fitting, etc. from which the contents are discharged.

Parallel: Referring to lines or surfaces that are equal distances apart at every point.

Partition: An interior wall separating two rooms or areas.

Penny: A term used to denote the length of a nail, as 6 penny or 8 penny.

Perimeter: The outer boundary of a figure or area.

Perpendicular: A line or plane at 90°, right angle, to another line or plane.

Pier: A masonry support either built into a wall or freestanding.

Pilaster: An attached pier, rectangular in plan, part of a column.

Piling: Wood, metal, or concrete post driven down into the earth to provide safe footing for heavy loads.

Pilot Light: A very small light which usually burns continuously. May be either gas or electric.

Pitch: The incline of a roof or of a run of pipe. The distance apart of a series of points as in screw threads or gear teeth. A black tarry substance used for roofing purposes.

Plumb: Vertical; parallel to a weighted or plumb line.

Pointing: The filling and finishing of joints in a masonry wall.

Portland Cement: Common gray cement. Named portland because when it was first manufactured it resembled the gray limestone from the Isle of Portland.

Post and Beam Building: A method of building in which the cross beams rest on vertical posts.

Preglazed: A window sash delivered to the job with the glass installed.

Prime Coat: The initial or first coat of paint. The priming coat is applied to fill the pores of the surface.

Purlin: Structural members spanning the trusses and used to support the roofing material.

Quarry: An opening excavation for obtaining building stones.

Rabbet: A groove cut in or near the edge of one piece of wood to receive another member, as seen in a door or window frame.

Rafter: A beam extending from a wall plate to the ridge of the roof.

Rendering: The art of coloring or shading a drawing; also of adding trees, shrubs, or people to give a lifelike appearance.

Return: A molding turned back into a wall on which it is located.

Ridge: The top edge of a roof where two sloping sides meet.

Ridgeboard: The wood member to which the rafters are nailed to form the ridge.

Rise: The vertical distance from the center of a roof span up to the ridge line. The distance between floors denoting stair rise.

Rocklath: A flat board used as a plaster base and made of gypsum composition, perforated to form a good bond.

Rubble: Roughly broken quarry stone or weather worn stone.

Run: The horizontal distance covered, as for stairs, or half the roof span.

Scab: A short length of wood nailed to the sides of two other pieces to hold them together.

Scale Drawing: A drawing which is made to a size or scale that is different from the actual size of the object drawn.

Schedule: A formal list of parts or details, as a window or door schedule.

Scratch Coat: The first coat of plaster which is scratched or scored to form a good bond for the next coat.

Screed: A wood strip used to help level a concrete floor.

Scribe: To mark by cutting or scratching a line.

Sea Level: The level continuous with that of the surface of the ocean at mean tide.

Septic Tank: A concrete tank, placed in the ground, into which the sewage is drained. Used when public sewers are not available.

Sheathing: The first covering on the outside of a house or roof.

Shed Roof: A single-pitch roof, sloping in one direction.

Shingles: Specially cut pieces of wood, slate, or composition material applied over sheathing as a wall or roof covering.

Shoring: Timbers used to brace a wall, usually for a temporary period.

Siding: The exterior covering of a building.

Sill: The bottom timber of a frame construction, which rests directly on the foundation wall. The member which is located across the bottom of door or window openings.

Slab: A term used to describe a flat area of concrete.

Sliding Door: A door which slides on a track into the wall or past another sliding door.

Soffit: The underside of parts of building, as the underside of a cornice, arch, or roof overhang.

Soil Stack: The vertical pipe into which the branch sewage pipes drain.

Sole: The horizontal member, called a shoe, in the framing upon which the studding rests.

Span: The distance between supports for rafters, trusses, or other members.

Specifications: The written description that accompanies a set of drawings and describes the work to be performed.

Stack: A pipe extending through the roof which serves to ventilate the plumbing system.

Stoop: A porch, platform, or entrance stairway at a house door.

Stringer: The side supporting members of a stairway. Sometimes called string or carriage.

Stucco: A coating for walls-consisting of cement, sand, and water.

Studs: The vertical members forming the skeleton framing of a structure, usually spaced 16 in. on centers.

Subflooring: The flooring under the finished floor.

Termite Shields: Sheets of copper placed on top of foundations to block termite invasion.

Terra-Cotta: Hard-baked clay, usually reddish brown or yellow in color. Often used for chimney flues.

Terrazzo: Floor construction using a mixture of marble chips and cement ground to a smooth finish. Then metal strips are used to outline a design and prevent cracking.

Thermostat: A device for automatically controlling the supply of heat or cool air.

Threshold: A stone, wood, or metal member which lies under a door.

Tie: A metal strip used in brick veneer to hold the masonry wall to the frame wall.

Toe Nailing: Driving nails into wood at an angle.

Trap: A device in a plumbing or drain system designed to prevent the passage of gases or odors. A device designed to permit the passage of one substance and to prevent the passage of another.

Trim: The light woodwork in a building, especially around openings.

Trimmers: Single or double joists or rafters around an opening in the floor or roof construction.

Troweled: Spread smooth with a trowel. A small hand tool used by masons.

Truss: A brace arrangement of metal or wood members designed to span between supports.

Utilities: Useful services such as gas, electric, and water.

Valley: The depression where two slopes of a roof meet.

Valley Jacks: Rafters that extend from a ridge board to a valley rafter.

Valley Rafter: A rafter used to form the depression where two sloping roof surfaces meet.

Valve: A mechanical device designed to regulate or shut off the flow of fluids or gases in a piping system.

Vapor Barrier: Thin nonporous sheets applied to framing to prevent condensed moisture from passing through walls.

Veneer: A comparatively thin layer of wood fastened over other wood, or a layer of masonry over a wood frame or other masonry.

Vent Pipe: A pipe in plumbing designed to ventilate the system and relieve the pressure due to flushing.

Vent Stack: The upper portion of a soil or water stack above the highest fixture.

Vertical: Perpendicular to a line or plane that is parallel to the horizon line or horizontal.

Vibrator: A shaking device which is immersed in concrete as it is being poured to distribute the mixture evenly and prevent voids.

Vitreous: Referring to composition of materials that resemble glass.

Wall Stringer: The side supporting member of a stairway along a wall.

Wall Ties: Usually metal strips placed in brick joints to hold two thin walls together or to secure a brick veneer to the inner wall.

Waste Stack: A pipe in the plumbing system into which the waste liquids are discharged. Usually a vertical pipe.

Waterproof: Referring to material or construction that has been treated to resist the penetration of moisture or water.

Water Table: A top level of the water in the ground. A string course or similar member below the outside covering of a building designed to deflect water from the building.

Weather Stripping: A strip of fabric or metal fastened along the edges of doors and windows to protect the interior against the weather.

Weep Hole: A small opening at the bottom of a wall or column to allow the drainage of moisture which may collect on the inside.

Withe: A vertical wall of brick one brick in thickness.

Working Drawing: A drawing containing dimensions and other information required to guide the workers in the erection of a structure.

Workmanship: The execution or manner of making or doing any portion of the work.